DECEMBER 18, 1950

Electrical World

A McGRAW-HILL PUBLICATION

NEW!

COMPACT! ECONOMICAL!

Murray LOAD CENTERS

with Fully Magnetic Circuit Breakers

that are Interchangeable with Other New Single Pole Individually Housed Breakers

Now you can get all the advantages of *fully magnetic* circuit breaker protection in load centers that are trim and compact — with breakers that are interchangeable with other new single pole individually housed breakers! Now you can get utmost flexibility with minimum stock — make up your own combination right on the job! Now you can forget about "derating" . . . now you can banish the nuisance of false tripping . . . now you can make satisfactory installations of circuit breakers in warm or poorly ventilated locations—where space and cost are important!

These compact new Murray load centers are available in 2, 6 or 8 circuit models. They come equipped with the sensational new *small size* Murray fully magnetic circuit breakers — now 30 per cent smaller than previous fully magnetic circuit breakers — available in ratings of 10 through 50 amp. They save you time . . . save you trouble . . . save you money — yet assure the user positive protection combined with utmost satisfaction!

Shallower Box—

—only 3 inches deep—ideal for flush installation in "dry wall" construction. Plus a simple ⅜" plaster line adjustment!

See for yourself why Murray fully magnetic breakers can't trip from heat . . . never need derating . . . always carry rated load plus harmless overloads—even in warm locations and poorly ventilated panels. Clear, simple diagrams tell the story in this folder. Write for your copy today.

Murray MANUFACTURING CORPORATION

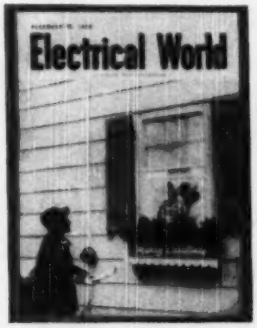
1250 ATLANTIC AVENUE • BROOKLYN 16, N. Y.

Electrical Safety Devices for Home and Industry

ABOUT THE COVER

Every year about the middle of November, Electrical World's managing editor Dan Braymer starts planning his Christmas cover. He plans a picture which will tell an industry story tied up with Christmas.

This year it was Dal Mallard, our consulting art director, who came up with the idea of two youngsters looking out a Christmasy window at a meter reader.



The girl is Dal Mallard's daughter Beverly, 14, who is a freshman at Kent Place school. The picture was snapped at their house at 2 West End Ave, Summit, N. J. The boy, who really didn't want to pose at all and was cajoled from tears just before the shutter snapped, is Richard "Ricky" Young, 3½, son of Mr. and Mrs. Lloyd S. Young, neighbors of the Mallards.

The meter reader, Warren Apgar, works for Jersey Central Power & Light Co.

It's a pretty good thing we snapped this picture on the day we did, because the next day was Saturday, Nov. 25, the day of the big blow, remember? About every utility worked around the clock that day and for several days following, restoring service in many areas after one of the worst land storms this part of the country has seen in years.

STATISTICAL ISSUE

Electrical World's next big project is well advanced and will soon be ready for the printer. This is the Statistical Number, which this year comes out on January 29, and which we'll tell you about more fully in a forthcoming issue.

THE EDITORS

Electrical World

Published for 76 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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Member ABC and ABP

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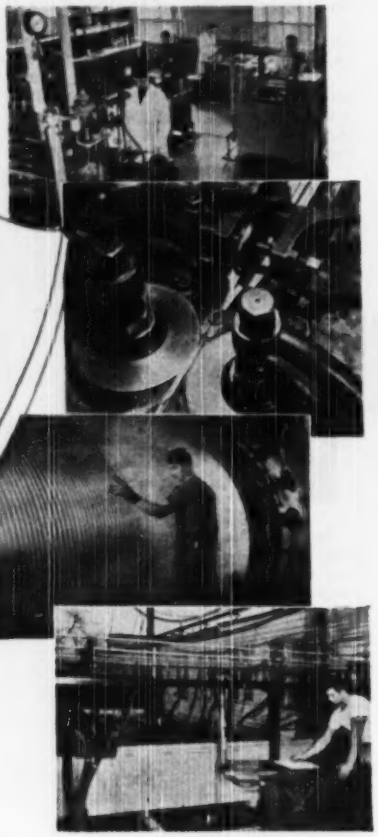
Its Long LIFE

Nearly 100 members of the Signal Section of the AAR inspected the entire Okonite operation, during the September meeting in New York. The Okonite plant is open to qualified personnel for an inspection at any time.



is an OPEN BOOK...

It's no secret why Okonite cable has a longer life than ordinary cable. The reason lies in rigid adherence to a program of *constant research*, the use of *proved materials* processed with *expert workmanship* and *modern manufacturing techniques*.

Okonite materials are different from, and superior to, those used in conventional cables. For example, Okonite insulation is made only with Up-River Fine Para rubber—the highest quality, longest-lasting, most uniform natural rubber available.

Okonite methods overlook no detail. For example, copper conductors are triple-cleaned: physically, chemically and electrolytically. They are coated not with tin, but with Okoloy, a corrosion-resisting lead alloy. All rubber for the insulation is washed and air-dried. Insulation and Okoprene sheath are applied simultaneously by the exclusive strip process and vulcanized *only once* . . . in a metal mold. This assures perfectly centered conductors, more stable and longer-lived insulation and sheath.

Such scrupulous attention to vital cable manufacturing steps characterizes every part of the Okonite process. Because of this, Okonite confidently subjects every finished cable not only to high voltage a-c tests, but also to self-imposed super-voltage d-c tests in excess of those used by any other manufacturer.

The life of an Okonite cable is an open book. We would like you to see for yourself the materials and methods that add years of life to Okonite cable. You can make arrangements for a plant visit through any of our district offices or simply write to The Okonite Company, Passaic, N. J.

THE BEST CABLE IS YOUR BEST POLICY

insulated wires and cables

8828

When sleet, wind, flood or fire interrupts your service, Graybar knows you must have replacement items *fast*. In spite of scarcities, Graybar has outstanding facilities for delivering them wherever and whenever you need them.

Our nation-wide network of more than 100 supply stations (warehouses and offices staffed with experienced personnel) provides broad accessibility to stocks of essential pole-line supplies. Our long-established relationships with select manufacturers assure their extraordinary co-operation in filling extraordinary needs. Our experience in hundreds of power-and-light emergencies gives us the know-how for immediate action and efficient follow-through.

Ever since the first distribution line was erected, power companies have been finding Graybar* service invaluable in emergencies . . . plenty helpful, too, in meeting everyday requirements. *Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.*

*Prior to 1926, Western Electric Supply Dept.

5097

IN OVER 100 PRINCIPAL CITIES

POLES • CROSSARMS • STRAND • INSULATORS • HARDWARE • PROTECTIVE DEVICES • LINE TRUCKS • CONNECTORS • TOOLS

WIRING NEWS

A PERIODICAL DIGEST OF WIRING IDEAS FROM THE GENERAL ELECTRIC CONSTRUCTION MATERIALS DEPARTMENT

Hot-Dip Galvanizing Makes the Difference!

Have you always assumed that *all* rigid conduit is the same? Or have you actually taken time to make comparisons? If so, you know that—because it's hot-dipped galvanized—General Electric White rigid conduit offers you extra value at no extra cost.

To hot-dip G-E *White*, steel pipe is immersed in a bath of pure molten zinc heated to 860 F. The entire hot-dipped process is carefully controlled to assure a constant, high-quality zinc coating for maximum protection against corrosion—more protection than that required by NEC standards.

G-E *White* is further protected by Glyptal* lacquer—both inside and outside. Tough and glassy-smooth, this coating actually helps to speed installation by making wire pulling faster and easier.

Remember, whenever wiring needs protection, it pays to give it the best protection you can buy—General Electric White rigid conduit.

* *Registered Trade Mark of General Electric Company*

1,000,000 Feet of Gas-Filled Cable in Successful Operation —Booklet Tells WHY!

Installed in 1938, the first test section of General Electric gas-filled cable continues to provide efficient service today. In fact, with more than one million feet of G-E gas-filled cable installed to date, there has *never* been a failure due to inherent causes.

Check box (A) in the coupon below for a copy of the "G-E Gas-Filled Cable" booklet. It contains complete data on gas-filled cable — explains the principle of self-supervision . . . lists the advantages of gas-filled cable . . . describes the three types of gas-filled cable . . . contains diagrams of typical gas-filled cable installations . . . shows how you can effect sizable savings through the use of G-E gas-filled cables.

Now—a New Wire that is Resistant to Gasoline and Oil!

Industrial concerns can save time and cut material costs when requirements call for lighting and control circuits at bulk fuel storage plants, refineries, and other locations. Where gasoline, gasoline vapors, and oil are present, recommend G-E Geotrol wire in conduit. No heavy, lead-sheathed cable is necessary — no additional protection is needed.

Lightweight, smooth, easy to pull through conduit, Geotrol wire has the same time-tested insulation as G-E Flamenol* cable. Added to this is an extra protective sheath that helps to resist deterioration by the hydrocarbons in petroleum products. Geotrol wire, available in seven bright colors and Awg sizes 14, 12, and 10, is listed by Underwriters' Laboratories, Inc., for use where oil, gasoline, and gasoline vapors are likely to occur. For more information, check box (B) in the coupon.

Get Measured Time-Delay with G-E Renewable Fuses

It pays to give circuits the best possible protection. Be sure you use General Electric renewable fuses . . . the fuses with the extra features.

These measured time-delay fuses employ a special link built to absorb heat during momentary overloads . . . prevents the fuse from blowing prematurely, reduces power-circuit interruptions. Yet, at the same time it gives quick, positive protection against dangerous "shorts" and overloads.

The G-E ferrule type renewable fuse has a patented, captive, hinged plate . . . reduces the number of loose parts to a minimum. That's why G-E time-delay fuses are so easy to renew. Simply unscrew cap . . . insert new, self-aligning link . . . and replace cap. That's all there is to it. The knife-blade type of renewable fuse also has a simplified construction . . . saves time . . . saves lost parts.

General Electric ferrule fuse ratings are from 3 through 60 amperes, knife-blade fuse ratings from 70 through 600 amperes — both for 250- or 600-volt service. Order them from your electrical supply house.

New Triple Outlets for G-E Remote Control

Here are the newest additions to General Electric's fast-growing remote-control wiring system; triple convenience outlets—one (RO-1) with common feed and common ground, the other (RO-2) with separate feed and common ground.

The RO-1 outlet answers the need for additional outlet facilities . . . helps to eliminate the jumble created by triple taps so often found in bedrooms and living rooms.

Home-owners prefer to have table lamps that light when the wall switch is turned ON. The RO-2 outlet simplifies this installation by permitting the control of one or two outlets, while the remaining outlet or outlets remain live.

These new General Electric triple convenience outlets are of one-piece construction. They have modern parallel, polarized slots and a slot-finding feature that guides plugs quickly into place. Plates are easy to clean and match the modern design of the remote-control switch plate. For complete information check box (C) in the coupon.

Section K18-1227
Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut

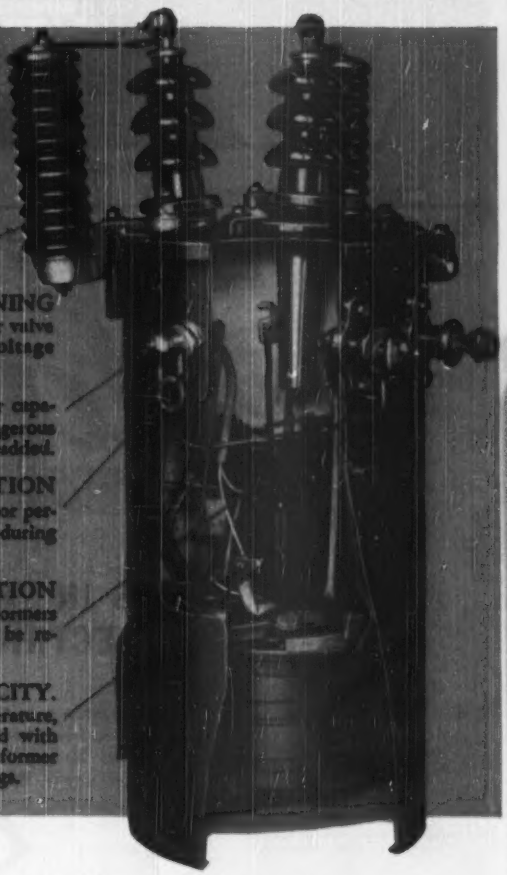
- ☐ A—Gas-Filled Cable Booklet
- ☐ B—Geotrol (Type TW) Cable
- ☐ C—New Triple Outlet

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____

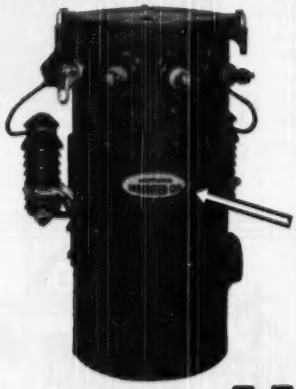
GENERAL ELECTRIC

Improve Consumer Service

...with ACP* Transformers



1. **NO INTERRUPTIONS FROM LIGHTNING** — even under severe surges. Arresters in either valve or expulsion type can be specified. High voltage protective links guard against feeder lockouts.
2. **LOADS DON'T OUTGROW** transformer capacity unnoticed. Signal light warns against dangerous overload conditions, and more capacity can be added.
3. **EMERGENCY SERVICE RESTORATION LEVER** provides temporary overload capacity or permits breaker to be reclosed to restore service during an extended overload period.
4. **LOW VOLTAGE SURGE PROTECTION** is provided by low voltage neutral gap on transformers with two high voltage bushings. Can easily be removed and replaced with a ground strap.
5. ***MORE*** **USEFUL OVERLOAD CAPACITY.** Secondary breaker, operated by either oil temperature, excess current or both, is closely coordinated with transformer thermal characteristics — lets transformer operate right up to actual safe limit of windings.



This seal on Allis-Chalmers distribution transformers means that an inhibitor has been added to improve still further the high quality of A-C Universal No. 3 insulating oil. The inhibitor extends the life of transformer oil because it retards oxidation, the major cause of sludge formation and destructive acids that attack insulation.

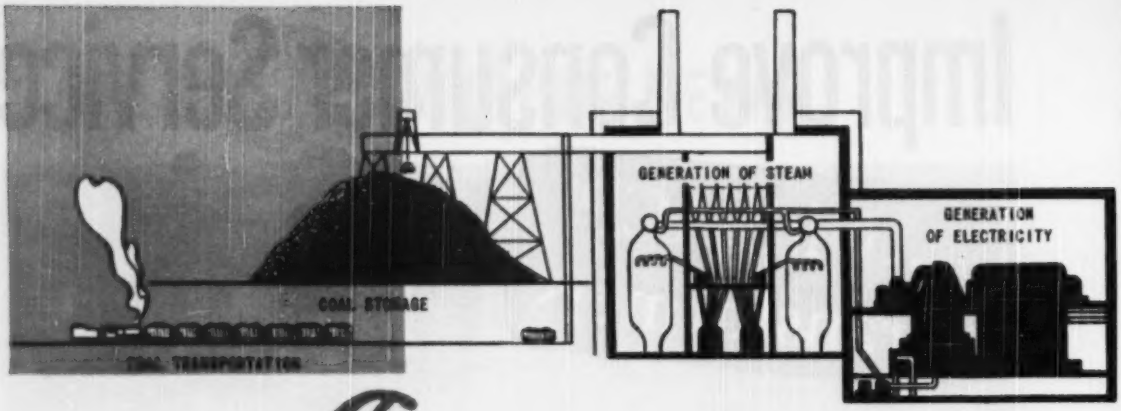
contains INHIBITED OIL

*ACP (Allis-Chalmers Protected) is an Allis-Chalmers trademark.

For more information on Allis-Chalmers distribution transformers, contact your nearby A-C sales office. Or write Allis-Chalmers, Milwaukee 1, Wis., for bulletin 61B7309A.

A-3248

ALLIS-CHALMERS

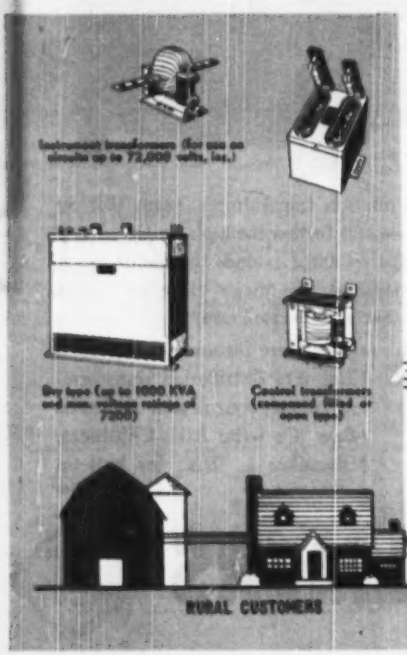


Standard

TRADE MARK ®

TRANSFORMERS

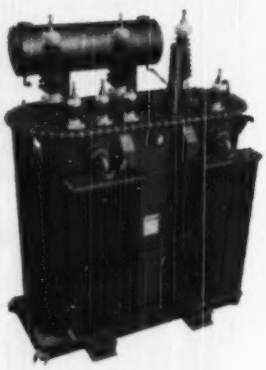
RELIABLE LINKS IN THE CHAIN OF DEPENDABLE ELECTRICAL SERVICE

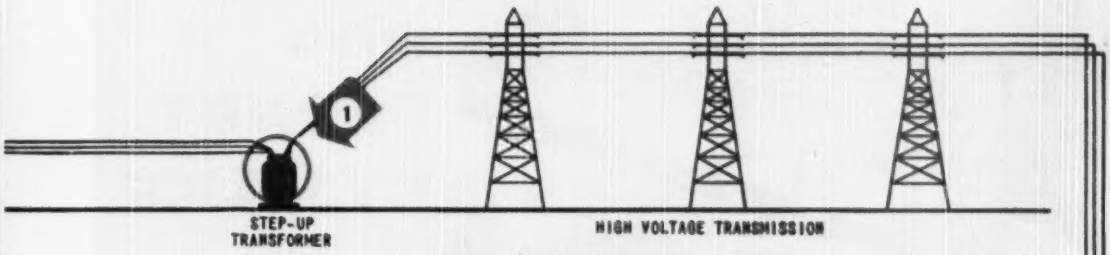

Dry type (up to 1000 KVA and max. voltage ratings of 7200)
Control transformers (compound filled or open type)
RURAL CUSTOMERS
RESIDENTIAL CUSTOMERS
STORES, OFFICES, ETC.

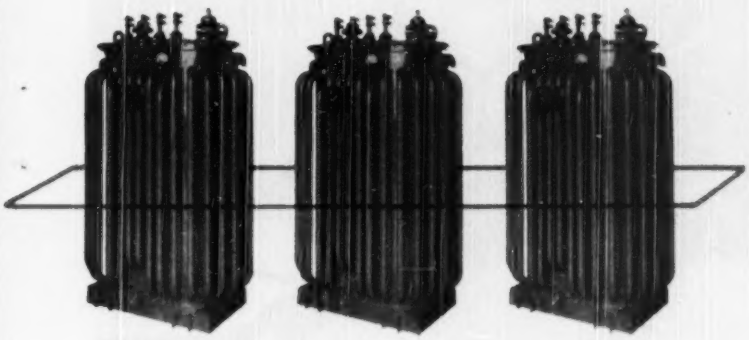
The Electrical Industry can depend on STANDARD to supply transformers for ANY APPLICATION in the production, transmission and distribution of electric power.

1 Power transformers, for your specific transmission requirements, whether special or standard, are available quickly, as STANDARD specializes in made-to-order transformers.

It takes no longer to get a specially designed transformer than it does a stock type.







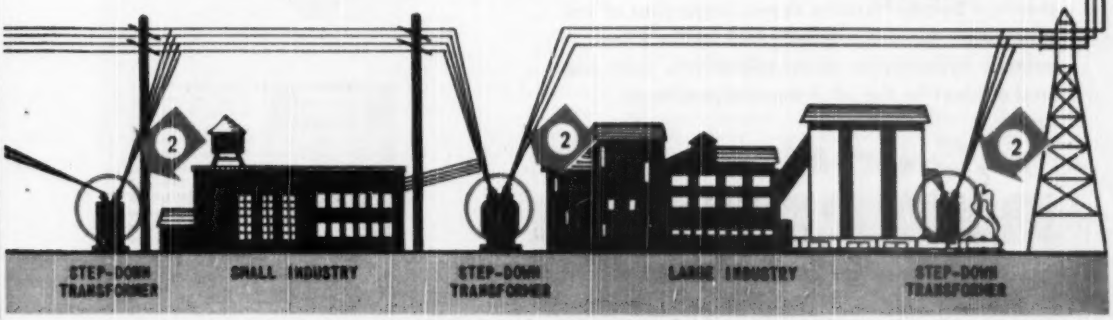
2 As in all of STANDARD transformers, substation types are designed to conform to industry standards. A complete range of sizes and types is built to the exact engineering specifications of the user. Space-saving and other economies are realized when you take advantage of STANDARD individualized engineering.

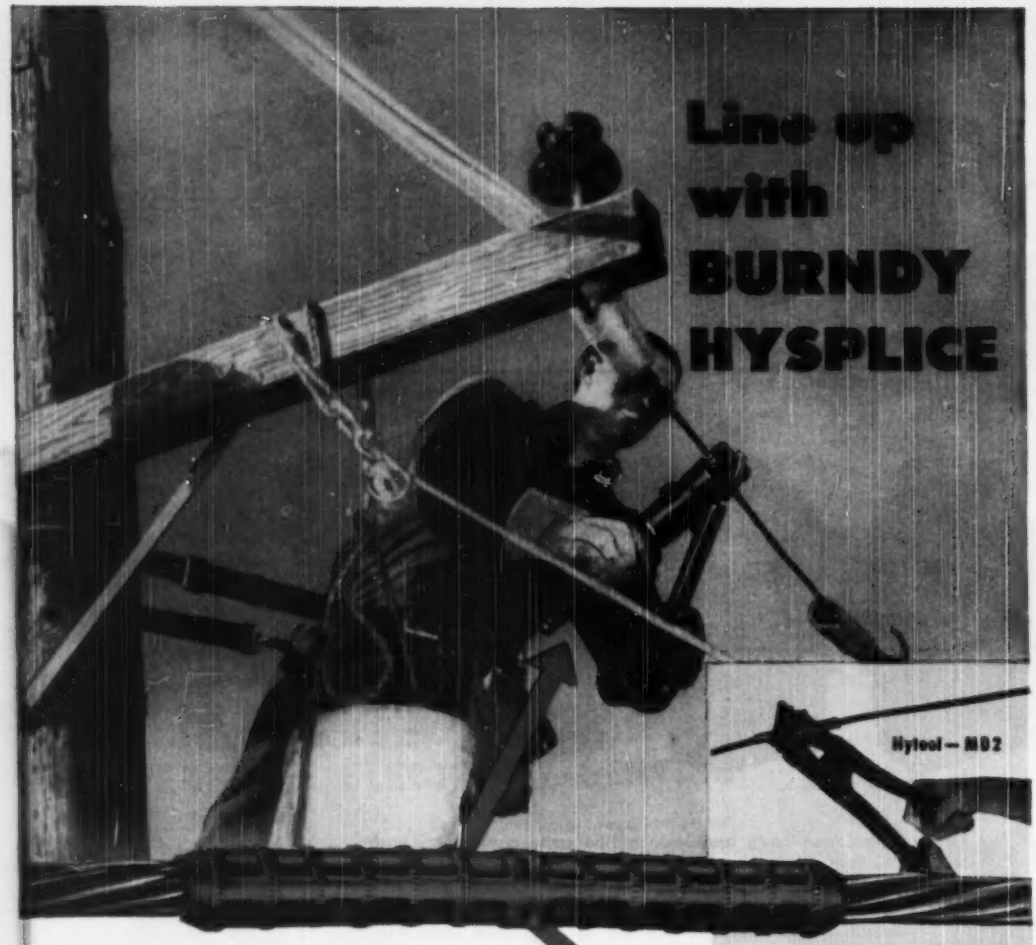
3 Lower installation costs and less maintenance are experienced by utilities that depend on STANDARD for pole type distribution transformers. Rural, urban and commercial services are economically maintained when STANDARD transformers are installed. Accessory protective devices may be selected to meet your individual standard. Every possible need, from power station to consumer, is better met through STANDARD transformers . . . specialists for a quarter century. Write for literature.

OFFICES IN PRINCIPAL CITIES

THE STANDARD TRANSFORMER CO.

WARREN · OHIO





Line up with BURNDY HYSPLICE

Hytool—MD2

Up goes the bucket with Hysplices and Hypress. Quickly, the 9-ton indenting force of the Hypress permanently joins conductor and Hysplice sleeve. The line is up...sure and secure wherever it has been Hyspliced!

For every overhead conductor and for every size, there's a Burndy Hysplice sleeve. Regardless of the installation, there is a Burndy tool for the job—manual, hydraulic or electrically-driven. Each one most efficient for the job it was designed to do.

Hypress—Y34-A

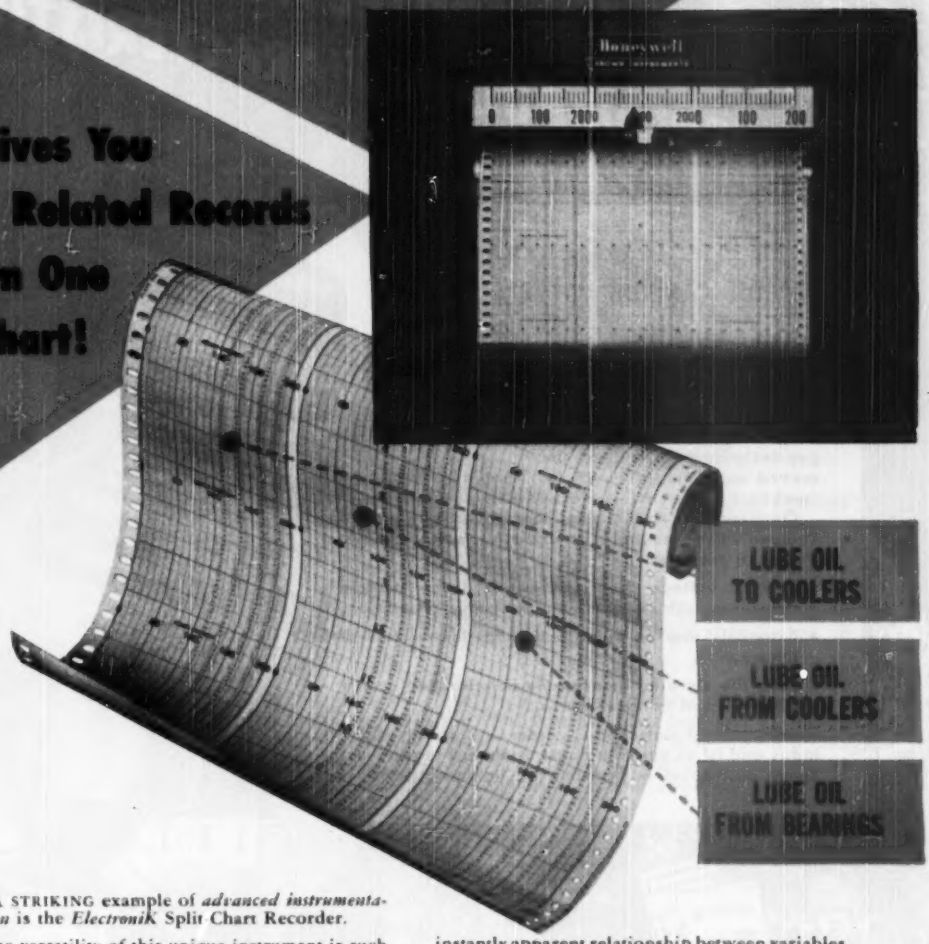
Connect with

BURNDY NEW YORK 54, N. Y.

Want to know about Hysplices for Copper, ACSR and other conductors? How about performance. Why do Burndy Hytools and Hypresses simplify splicing? 28-page HYSPLICE CATALOG gives you the answer. Write Burndy for your copy.

• THIS SPLIT-CHART *ElectroniK* RECORDER

Gives You 3 Related Records On One Chart!



A STRIKING example of *advanced instrumentation* is the *ElectroniK* Split Chart Recorder.

The versatility of this unique instrument is such that it will record any two or three variables (temperature or pressure, for example) . . . or any single variable from different pieces of equipment . . . on *one* dual or triple-section chart. Typical is the chart illustrated which shows temperature records of lube oil to coolers, from coolers, and from thrust bearings.

This instrument is a natural for efficiency and economy-minded operators. It simplifies comparison of records between equipment . . . makes instantly apparent relationship between variables . . . effects economies in mounting space and original costs.

You will benefit from a discussion of this recorder with your local Honeywell engineer. Call him today . . . he is as near as your phone!

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division,* 4568 Wayne Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

HIGH SPEED PROTECTION
LOW IMPULSE CHARACTERISTICS
FAST MULTI-GAP SPARK GAP OXIDIZED
SILICON CARBIDE VALVE ELEMENT
All are features that make possible the high-speed operation of Crystal Valve Lightning Arresters . . . assure your equipment and service of extra protection against lightning "blackouts."
Speed of operation is controlled largely through spark gap design and construction. Crystal Valves embody time-proved spark gap units of multi-gap construction and sparkover or discharge surfaces that are smooth and flat.
Oxidized Silicon Carbide, today's most highly developed valve element, is an exclusive feature in Crystal Valves. It provides:
• Low IR voltage drop and ample surge voltage reduction, with adequate surge energy absorption.
• Extremely marked valve action for follow current interruption.
• Long life since no measurable deterioration occurs after years of normal service.
Specify proved protection . . . order Crystal Valves. Write today and let us put your name on the list to receive our series of instructive booklets on lightning protection.
ESM
LIGHTNING ARRESTERS

ELECTRIC SERVICE MANUFACTURING CO. • 1709 Cambria St. • Philadelphia 32, Penna.

CRYSTAL VALVE
LIGHTNING ARRESTERS

When you think of Electric Heat,

think of Hoskins Chromel*

It's a good idea, from time to time, just to sit back and think about electrical heating appliances. Ranges, roasters, irons, toasters . . . water heaters, clothes dryers, space heaters, and all the other domestic heating devices connected to your lines. Think about how many of each there are in use today . . . and the KWH consumed by them over an average year's operation. Then figure out roughly what this tremendous heating load means in relation to your total power sales.

As a starter . . . just from readily available consumer statistics, you will find upwards of *130 million* domestic heating appliances being used in America's homes today. Collectively, their operation will require around *30 billion* KWH during the present calendar year. And this collective figure has been estimated to represent better than 45% of the total electrical energy used for domestic purposes. (All statistical sources available upon request.)

Why think about Hoskins CHROMEL when you're thinking of electric heat? Simple! Because Hoskins CHROMEL is the *original* nickel-chromium resistance alloy that *first* made electrical heating practical. It is used wherever you carry a heating load . . . whether domestic, commercial, or industrial. In fact, its consistently fine dependable durability has been an all-important contributing factor in helping you develop and maintain this profitable phase of your business.

Our Catalog M-1 contains helpful information for your Load Building Department . . . want a copy?

HOSKINS MANUFACTURING COMPANY

4445 LAWTON AVE. • DETROIT 8, MICHIGAN

NEW YORK • CLEVELAND • CHICAGO

West Coast Representatives in Seattle, San Francisco, Los Angeles
In Canada: Walker Metal Products, Ltd., Walkerville, Ontario

**the original nickel-chromium resistance alloy that first made electrical heating practical*

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

ONE WEAK LINK

in your high-voltage motor control

CAN BE COSTLY

2300-4800 voltage systems pack a punch! It takes more than just a starter for *safe* control of motors connected to these systems.

What's the answer? The three-way co-ordinated protection of Westinghouse Combination High-Voltage Starters. They combine high interrupting capacity with motor and personnel protection—in one unit. Contactors and fuses, as well as all other components, are designed for each other . . . made to work together . . . balanced for the best results.

Each link of this three-way protection is of equal importance. You get positive fault protection with type BAL fuses. Heavy-duty contactors —either oil-immersed or air-break type—guard the motor. Sectionalized cabinets offer protection for personnel.

Ask your Westinghouse salesman to give you full details and a copy of "Co-ordinated Protection", booklet B-4673. Or, write directly to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-27003

Westinghouse
HIGH VOLTAGE STARTERS

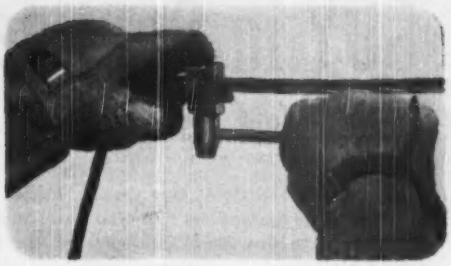
Simple as 1-2-3 to Install...

FARGO CONNECTORS

Hold Wires Permanently!

1st: HOOK ON RUN

2nd: INSERT TAP



3rd: TIGHTEN BOLT

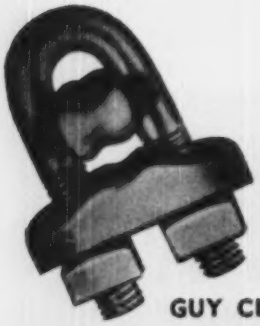
"...built like a vise ---grips like a vise"

FARGO

AVAILABLE IN ALL TYPES

Fargo vise-type connectors are available in lap, straight and diagonal jaw designs. Plated spacer bar types are recommended for dissimilar metal connections. There are also heavy-duty, two-bolt spacer bar types, with "one-piece" features, for transmission and heavy primary applications.

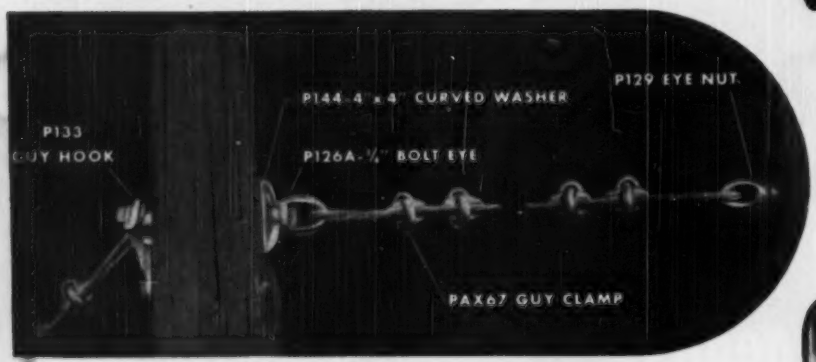
*Approved by Underwriters' Laboratories, Inc.



GUY CLAMPS

WASHERS

GUY HOOKS



EYE NUTS

BOLT EYES

GUY in Confidence

with M.I.F. "field tested" Guying Specialties!

Each M.I.F. Guy Hook, Guy Clamp, Washer, Bolt Eye and Eye Nut was developed by men who have climbed the poles, men who have first hand knowledge of the importance of dependable fittings.

Through bolt guying, pioneered by M.I.F., is now accepted as general practice. M.I.F. through bolt guying devices have no equal for economical installation, maintenance free operation and long service life.

Write for descriptive literature

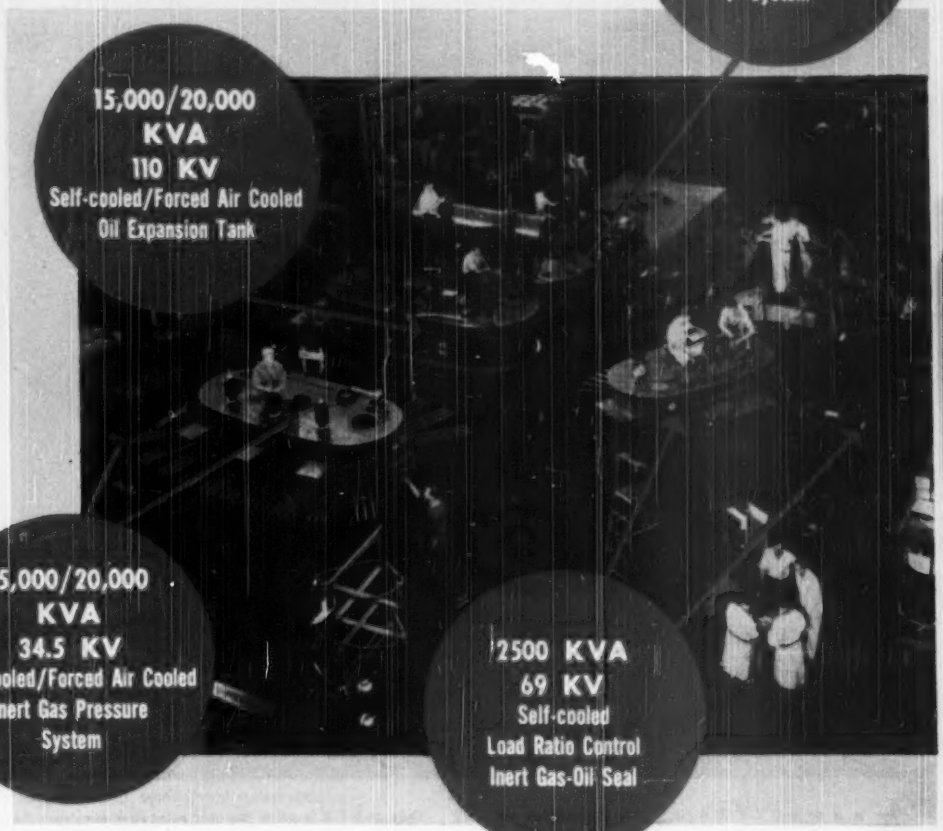
MALLEABLE IRON FITTINGS CO.

POLE HARDWARE DIVISION — Branford, Connecticut

N. Y. OFFICE: 30 Church St. — Canadian Mfr. & Dist.: LINE & CABLE ACCESSORIES, Ltd., TORONTO

Representatives: WM. J. COTTRELL CO., Portland, Ore. • JAMES H. DREW CORP., Indianapolis, Ind. • INDUSTRIAL ENGINEERING & EQUIPMENT CORP., Los Angeles, Cal. • MINTEER & JOSLER, Chicago, Ill. • E. A. THORNWELL, INC., Atlanta, Ga. • J. P. VOIGHT, Summerville, S. C. WALTHAM, DE WITT & KRUSI, San Francisco, Cal. • L. R. WARD CO., Dallas, Tex. • WILLIAMS SALES AGENCY, Fort Meyers, Fla. • O. C. WITTE CO., Detroit, Mich.

POWER TRANSFORMERS assembled HERE..



This section of the Pennsylvania plant is known as the Finishing Department. All Power transformers stop here for final assembly and finishing before going to the Test Department.

The group of transformers pictured is representative of the types of Power transformers designed and manufactured by Pennsylvania.

Transformers in this group range from 2500 Kva to 30,000 Kva. Some are equipped with no load tap changers; others with underload tap changers.

Many types of cooling methods are represented — self-cooling, forced air cooling, and forced oil cooling.

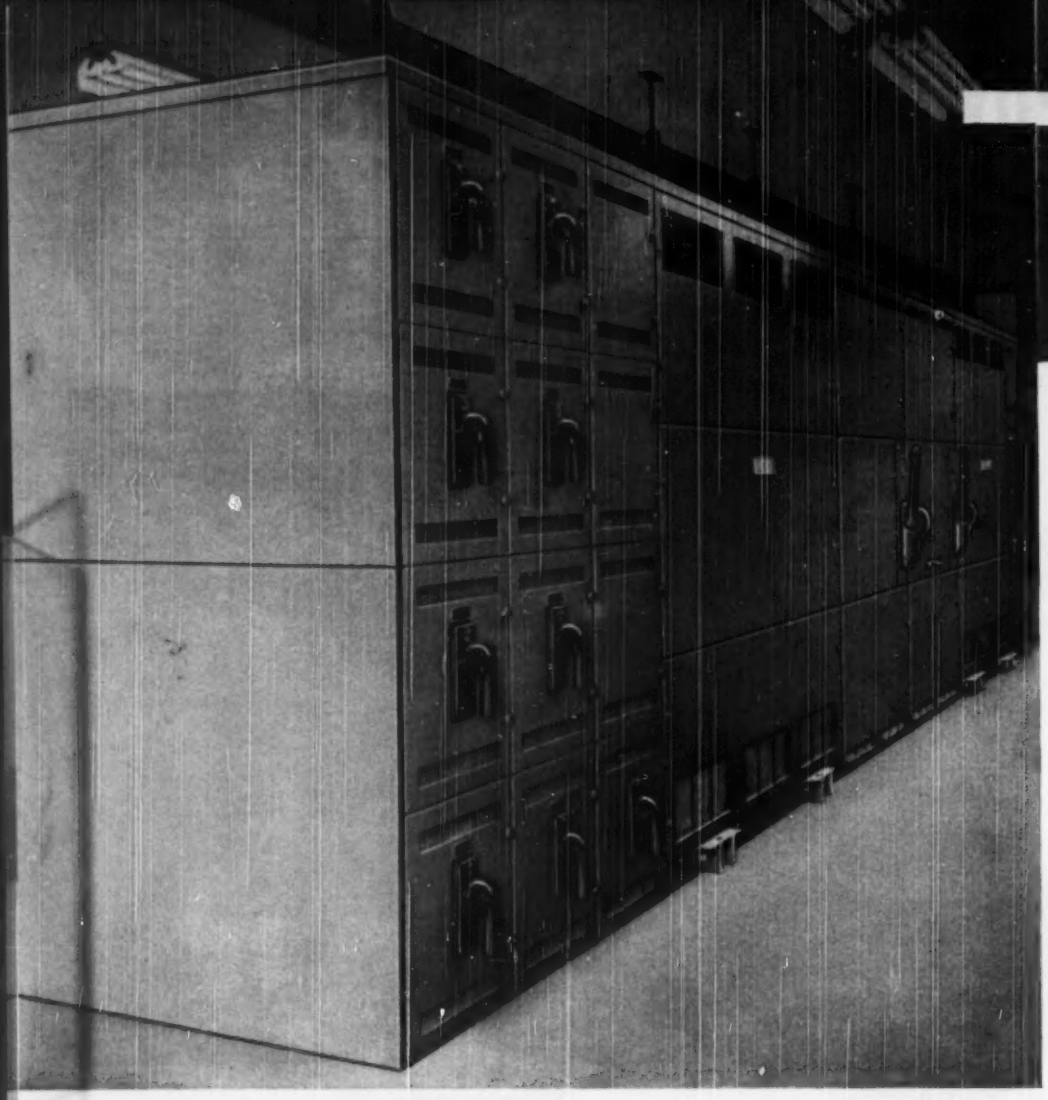
Methods of oil preservation include Inert Gas-Oil Seal, Oil Expansion Tank, and Inert Gas Pressure Systems.

Other Power transformers regularly built by Pennsylvania have ratings up to 100,000 Kva and voltages up to and including 230 Kv.

Pennsylvania TRANSFORMERS

Pennsylvania TRANSFORMER COMPANY

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*



Here is a typical I-T-E indoor Unit Substation with air cooled transformers. Substation arrangement puts primary load break interrupter switches *and* transformers in the center. As load grows, addition of low voltage switchgear to either end is simple and inexpensive.

Uniform appearance of the structure and symmetry of enclosing panels are consistent with the operating excellence of I-T-E switchgear.

Only at I-T-E is *all* of the unit substation enclosure designed, manufactured and assembled in the *same* plant of one division of the company. Quality control is consistently maintained and coordination is assured. Results are simplified installation and improved appearance for *your* plant.

There's an I-T-E Field Application Engineer near you to help you in planning for the future with sound engineering information about I-T-E Unit Substations. Call him today!

I-T-E

For *more dependable* Switchgear

Save your money these ways

1 REDUCED CONDUCTOR INVESTMENT AND MAINTENANCE

I-T-E Unit Substations distribute low voltage a-c energy to the load with shorter bus or cable runs.

2 LOWER COST OF LOW VOLTAGE METAL ENCLOSED SWITCHGEAR

Reduced transformer sizes at load centers require lower interrupting capacity circuit breakers, with resulting savings in switchgear costs.

3 SMALLER WORK AREA AFFECTED BY POWER INTERRUPTION

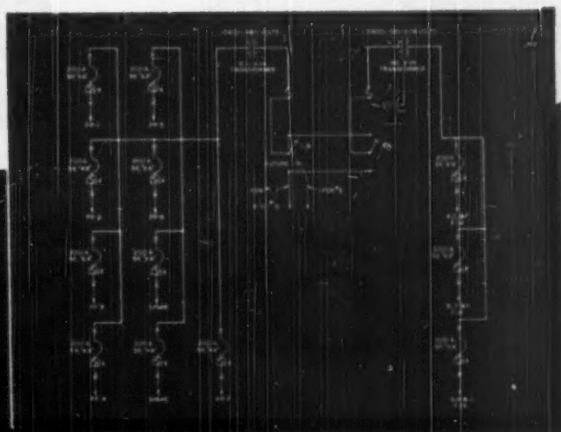
With individual I-T-E Unit Substations spotted at load centers, substations may be moved as load centers shift. Manufacturing processes in other sections of your plant are not affected — production is sectionalized.

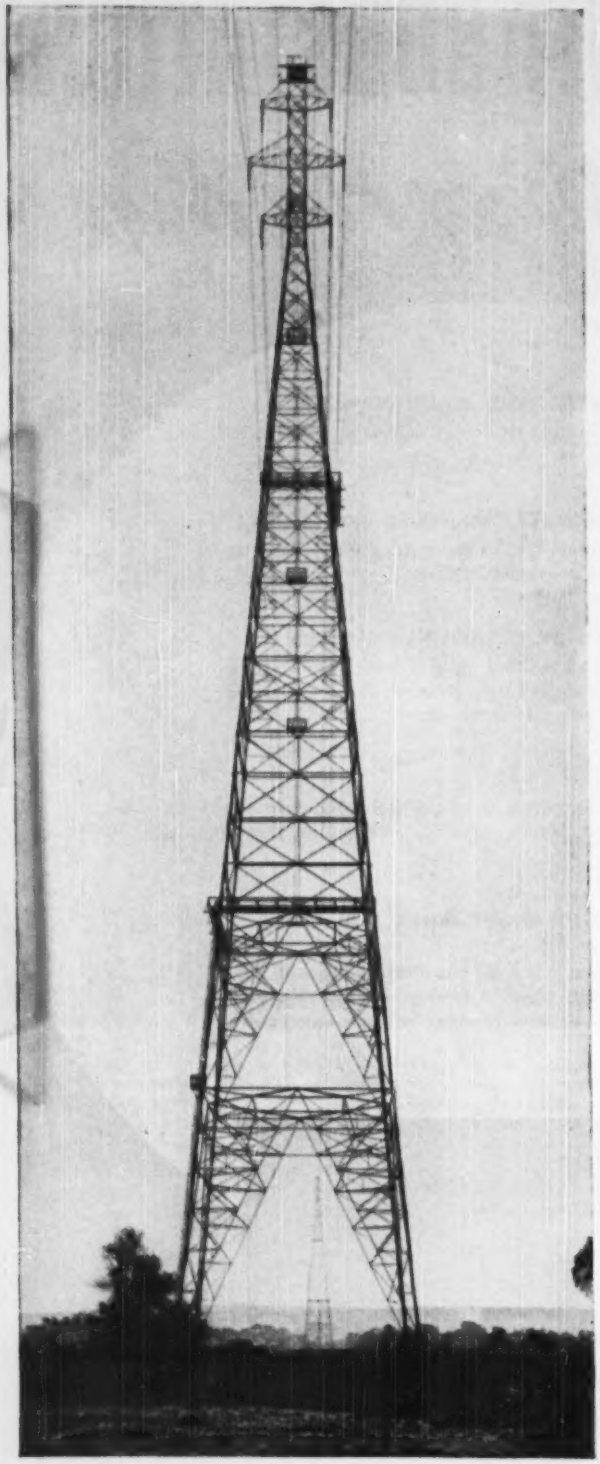
4 TIME SAVED AT INSTALLATION

Piecemeal deliveries involve storing, assembling, testing. I-T-E substations are shipped to you as complete packages: factory engineered, assembled, tested before delivery. Time means money — save it!

5 TIME AND MONEY SAVED IN YOUR ENGINEERING AND PURCHASING DEPARTMENTS

Reduce your engineering specifications to a simple, one-line diagram—all you need to secure a quotation, complete with physical arrangement drawings and specifications covering all components of the substation: primary switchgear, transformer, secondary switchgear.





Years of Experience in Tower Design *and* Fabrication

When you entrust the design of transmission towers to Bethlehem, you can count on getting towers to meet your every requirement. This is because our engineering staff has had years of experience in designing single- and double-circuit towers, not only for varied types of terrain, but also for difficult wind and weather conditions. Our shops are well located, and are equipped to handle every phase of tower fabrication, including galvanizing. Get in touch with Bethlehem for your next tower job.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
FABRICATED STEEL CONSTRUCTION

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

★ BETHLEHEM STEEL ★

500 ft, 230-KV Columbia River Crossing Tower, Portland, Ore. Designed and fabricated by Bethlehem for U. S. Dept. of Interior. Conductors, 801,900 cm 44/37 A.C.S.R.; ground wires, ¾ in. diameter extra-high-strength steel; crossing span, 3,756 ft; base width, 84 ft, 2 in.; vertical separation between conductors, 24 ft; horizontal separation between top and bottom conductors, 27 ft; between middle conductors, 37 ft; ground wire separations, 14 ft, 6 in.; top crossarm to ground wire, 12 ft.

YOU CAN BE **SURE**.. IF IT'S
Westinghouse

..with the type ASR Synchronizing Relay

Getting the motor started right every time—and providing complete protection at all times—are the basic functions of the new Westinghouse SLIPSYN Synchronous Motor Control.

Heart of the new SLIPSYN is the amazing Type ASR synchronizing relay. Characterized by its extremely simple, sturdy and reliable design, this new relay is especially suited for heavy industrial service.

The ASR not only applies the field at the proper speed, but also at a favorable rotor position for best synchronizing performance. It is easily adjusted on the job for best operating conditions under actual load.

*Trade Mark

SLIPSYN is the name applied to the complete line of Westinghouse Synchronous Motor Control. Standard types are available for operating and protecting all types of synchronous motor drives. Find out all the advantages of SLIPSYN controls now. Call your nearest Westinghouse office or write for Booklet B-4379. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-21588

CORNELL-DUBILIER CAPACITORS
FOR POWER-FACTOR IMPROVEMENT

Detroit Utility reports:

OVER 1½ BILLION KVAR HRS.

OF 99.1% TROUBLE-FREE OPERATION from its

C-D CAPACITOR INSTALLATION!

Part of a 35,840 Kvar C-D installation used by this system to maintain a uniformly high system power factor in a heavy industrial load area.

"But how does it stand up in the field?"

There's only one way to get the answer — not from a blue-print, not from a lab report, but from actual, time-tested installations *in* the field!

You need *facts* like these: "Detroit Utility reports that its Cornell-Dubilier capacitors have delivered 1,863,952,800 Kvar/hrs. of 99.1% trouble-free operation to date". A field performance record for unmatched dependability!

MORE C-D FEATURES:

- **Heavy-duty, multi-petticoat, wet-process, glazed porcelain bushings. Longer creepage path; less breakage hazard; high impulse rating.**
- **Wrap-around bracket — another C-D exclusive! Two wraps extending around sides affording greater safety against impact stress in shipping and handling.**
- **Terminal discharge resistor connected to each series section, instead of terminal to terminal. Provides effective discharge for each series group and balanced voltage distribution.**
- **Small sections in series-parallel results in low voltage gradient per section; less heating; lower power-factor; lowest dielectric unit stress.**

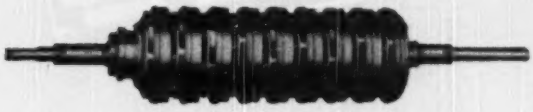
Our engineers will be glad to show you why long life and dependable service are built-in characteristics of Cornell-Dubilier capacitors. Catalog on request.
CORNELL-DUBILIER ELECTRIC CORPORATION, Department D-12, South Plainfield, New Jersey.

OTHER PLANTS IN New Bedford, Worcester and Brookline, Mass.; Providence, R. I.; Indianapolis, Ind., and Cleveland, Ohio.

distinctively new

Ingersoll-Rand
Multi-Stage Centrifugal Pumps

with unit-type rotor assembly



Here's a high-pressure pump that's *completely modern* in every detail—a compact, streamlined unit that combines all the latest advances in hydraulic engineering.

Ingersoll-Rand Class HMTA pumps feature a simplified, high-strength, horizontally-split casing, and a unique *unit-type rotor assembly*. The multiple volute passages between stages are contained in precision-machined channel rings—assembled on the rotor shaft and locked in position within the smooth, symmetrical bore of the casing. The rotor-assembly elements are all self-aligning—all precision machined to fit together as a unit.

The result—a more efficient, longer-lasting high-pressure pump that offers important savings in operating and maintenance costs. Available in capacities to 1600 gpm and pressures to 1200 psi.

FOR COMPLETE INFORMATION ask for your copy of Catalog 7233.

IN DESIGN
IN CONSTRUCTION
IN PERFORMANCE

HMTA

for pressures up to 1200 psi

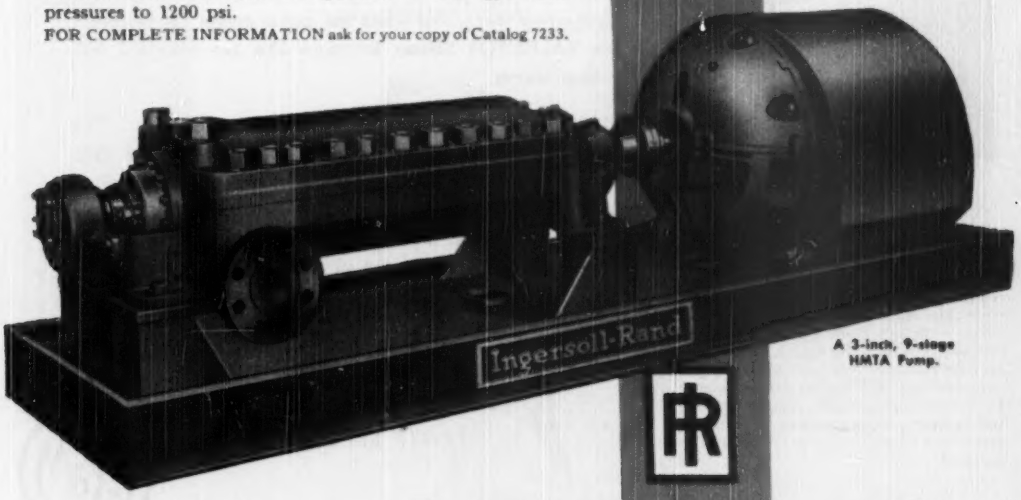
HIGHER SUSTAINED EFFICIENCY—made possible by perfectly-matched, self-aligning impeller and channel ring assemblies, with all running clearances proportioned for minimum wear.

EASIER MAINTENANCE AND LESS OF IT—with simplified, rugged construction throughout and easy accessibility of all parts.

SYMMETRICAL, MAXIMUM STRENGTH CASING—because the unit-type rotor assembly eliminates the need for a casing with intricate, cast volute passages.

LOWER PARTS INVENTORY—because maximum interchangeability of rotor-assembly parts makes it unnecessary to stock replacement units for each individual stage.

FLEXIBILITY OF OPERATION to meet changing load conditions—because pump characteristics can be altered by installing a new combination of rotor-assembly units.



A 3-inch, 9-stage HMTA Pump.

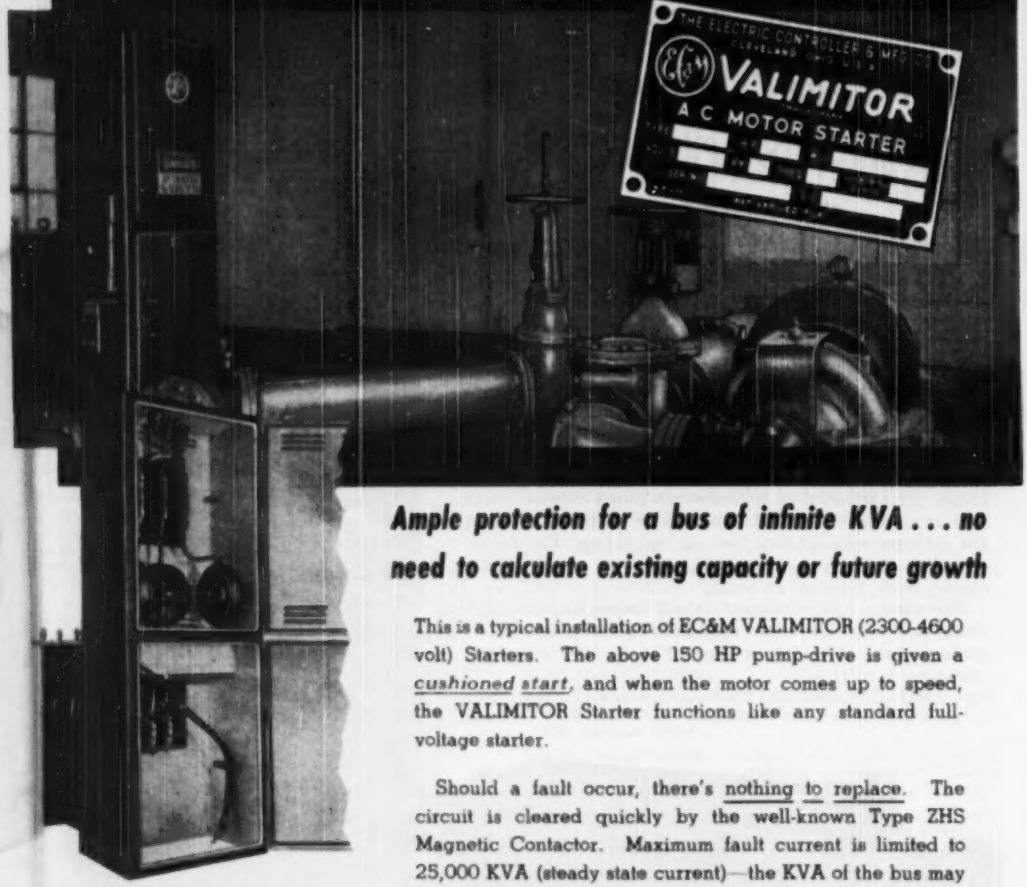
COMPRESSORS • AIR TOOLS • ROCK DRILLS
TURBO BLOWERS • CONDENSERS
CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

Ingersoll-Rand

CAMERON PUMP DIVISION
11 BROADWAY, NEW YORK 4, N. Y.

350-18

Throughout the Nation-
Short Circuit Problems Are Being Solved by EC&M VALIMITOR (VOLT-AMPERE LIMITOR) STARTERS



Ample protection for a bus of infinite KVA . . . no need to calculate existing capacity or future growth

This is a typical installation of EC&M VALIMITOR (2300-4600 volt) Starters. The above 150 HP pump-drive is given a *cushioned start*, and when the motor comes up to speed, the VALIMITOR Starter functions like any standard full-voltage starter.

Should a fault occur, there's nothing to replace. The circuit is cleared quickly by the well-known Type ZHS Magnetic Contactor. Maximum fault current is limited to 25,000 KVA (steady state current)—the KVA of the bus may be infinite. Actual fault currents will be further restricted due to impedances inherent in every system.

EC&M VALIMITOR Starters are easy to apply. Order them by HP, voltage, phase and frequency.

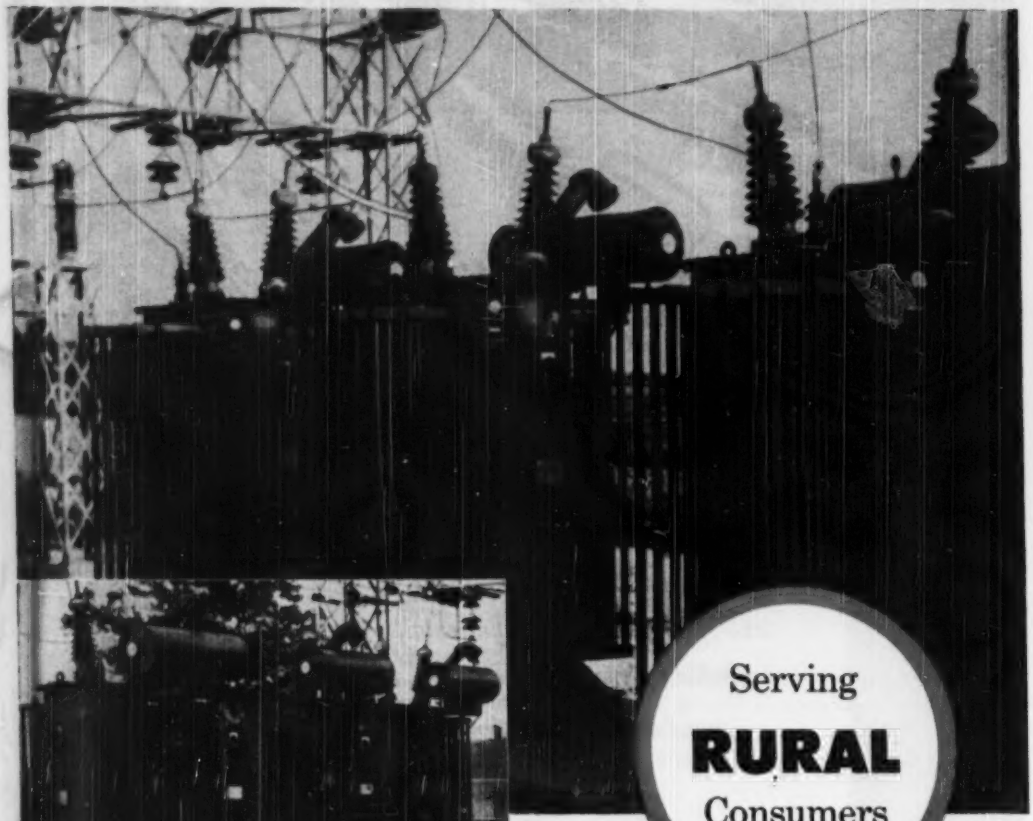
MAGNETIC-LATCHED Starters automatically restart after voltage dips—A new Under-Voltage Protection circuit holds the contactor closed with full spring pressure on the contacts down to a low voltage. If voltage fails, the contactor drops out *cleanly*. The contactor will be automatically reclosed by a small timing relay, and the motor will restart if voltage returns to normal within the timing of the relay (about 2 seconds).

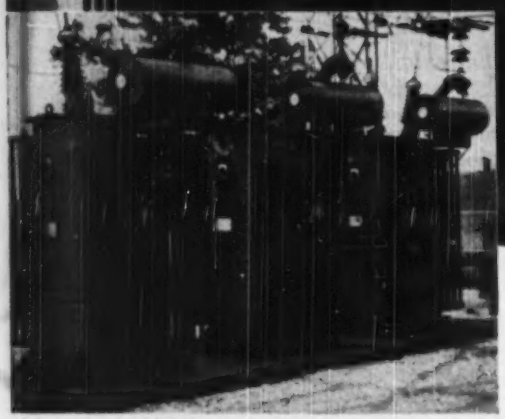
For Complete Facts—Ask for
T9-117 REPRINT Bulletin

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

Season's Greetings
. . . to the great industry it has been our privilege to serve for thirty years . . . with personal "best wishes" to the men who specify, purchase and install Pinco products, from those who make and sell them.
PINCO INSULATORS
The Porcelain Insulator Corporation • • • LIMA, NEW YORK

Uptegraff POWER Transformers





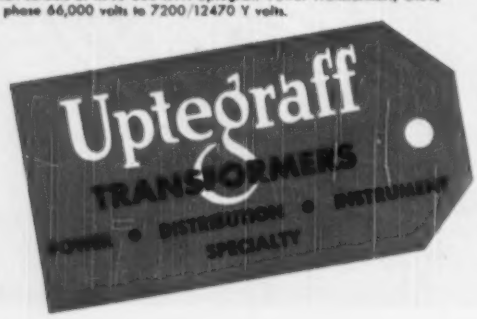
● Two views of a 2500 KVA substation, serving rural consumers. The installation consists of three 833 KVA Uptegraff Power Transformers, OISC, single phase 66,000 volts to 7200/12470 Y volts.

Serving RURAL Consumers

Where transformer dependability is essential to continuity of service, you can rely upon the built-in quality of Uptegraff POWER Transformers. This has been amply demonstrated by the operating records of Uptegraff Transformers in numerous rural systems.

Design and construction details reflect extensive experience and skill in the manufacture of transformers. Uptegraff versatility and manufacturing flexibility permit the prompt delivery of transformers made to meet *your* particular requirements.

Uptegraff Power Transformers are made in sizes up to 10,000 KVA, 69 KV for indoor or outdoor service.



R. E. UPTEGRAFF MANUFACTURING COMPANY
SCOTTDALE, PENNA.

"SEEING EYES"

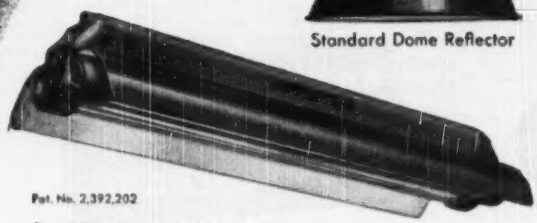
for PROFITABLE PRODUCTION

Without good clear vision on the job, even the most skilled production worker falls short of top performance. That's why good lighting equipment is a basic essential for consistently profitable production. Appleton Lighting Fixtures provide the *right* light, without uncomfortable glare, troublesome contrast or shadow. Each type is a model of mechanical simplicity—economically installed, easily wired, conveniently serviced.

Products of more than a half century of experience, Appleton Lighting Fixtures are made to suit every industrial requirement—including hazardous locations—whether indoors or out. For the finest illuminating equipment or expert assistance on any lighting problem, contact Appleton—Standard for Better Lighting.

Standlite High Mounting Fixture
For High Bay Interiors

Standard Dome Reflector



Pat. No. 2,392,202

The EFU—First and Still Finest
Fluorescent Explosion-Proof Lighting Fixture

Two sizes: for two 40 Watt, 48" Lamps
or two 100 Watt, 60" Lamps.

Pat. No. 2,530,135

Type EVX Vented
Explosion-Proof Fixture

Available for 60, 100, 150, 200, 300 and 500 Watt Lamps.

Standlite—for Filling Stations, Parking Areas

SOLD THROUGH ELECTRICAL WHOLESALERS

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CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

FIGHT POLE FAILURES WITH U·S·S CREOSOTE OIL

● For more than 100 years, the wood preserving industry has found creosote oil the surest protection against wood's natural enemies. It is highly toxic to termites, borers, fungi and dry rot. And its oily nature helps to minimize the checking and cracking due to temperature changes.

With proper creosote oil treatment, you can greatly reduce natural failure of poles and crossarms . . . hold future replacement costs to a minimum.

To obtain maximum protection, use or specify U·S·S Creosote Oil. Continuous processing in the world's largest tar distillation plant assures you *consistently high* quality . . . consistently good results. For complete information, contact the nearest sales office listed below.

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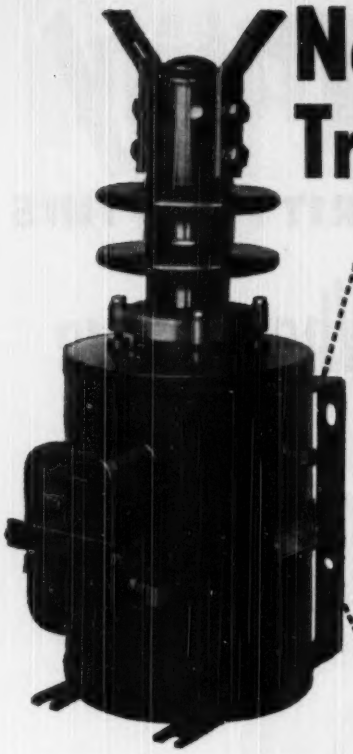
Brown-Marx Building, Birmingham 2, Ala. 25 Beale St., San Francisco 5, Calif.

USS

CREOSOTE OIL

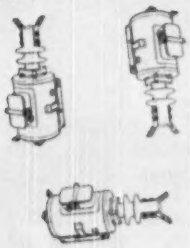
UNITED STATES STEEL

New Outdoor Current Transformer Type KO



Type KO Outdoor (compound-filled) current transformer. Available in standard current ratings up to and including 800 amperes and three voltage classes: 5, 8.7 and 15 KV.

Mounts in Any Position



Type KO current transformers solve your installation problems in more ways than one. Mount on frame, pole or platform, in any position to meet your system requirements.

ALLIS-CHALMERS
CURRENT TRANSFORMERS

Highly Accurate on Metering Burdens

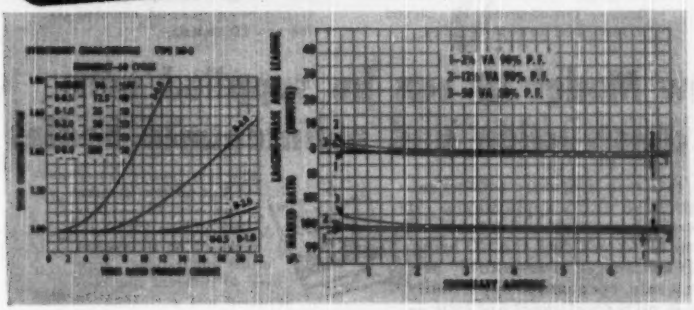
NEW VERSATILITY in mounting . . . high accuracy in metering and heavy duty relay application — that's the story on the new Type KO out-door current transformer. Linemen like it because they can install it quickly, easily in any position.

Primary leads are brought out conveniently to blade type terminals through a porcelain bushing designed with generous creep surface. Secondary leads terminate in a weather-proof terminal box. Box cover readily swings open after loosening the barrel type locking bolt — no parts to drop or lose. Secondary connection through conduit openings made to stud type terminals in this sealable compartment.

Type KO transformer housing is completely welded, pressure tested and hermetically sealed. Maximum insulation strength is achieved by compound filling under a "vacuum-pressure" process which entirely eliminates air. This results in low power factor and a maintenance-free installation.

For more information on Allis-Chalmers wide range of instrument transformers write for bulletin 61B7168 or see your nearby A-C sales representative. A-3143

ALLIS-CHALMERS, 932A SO. 70 ST. MILWAUKEE, WIS.



The excellent performance of Type KO current transformers is represented in the above curves. They meet or better ASA and NEMA standards.

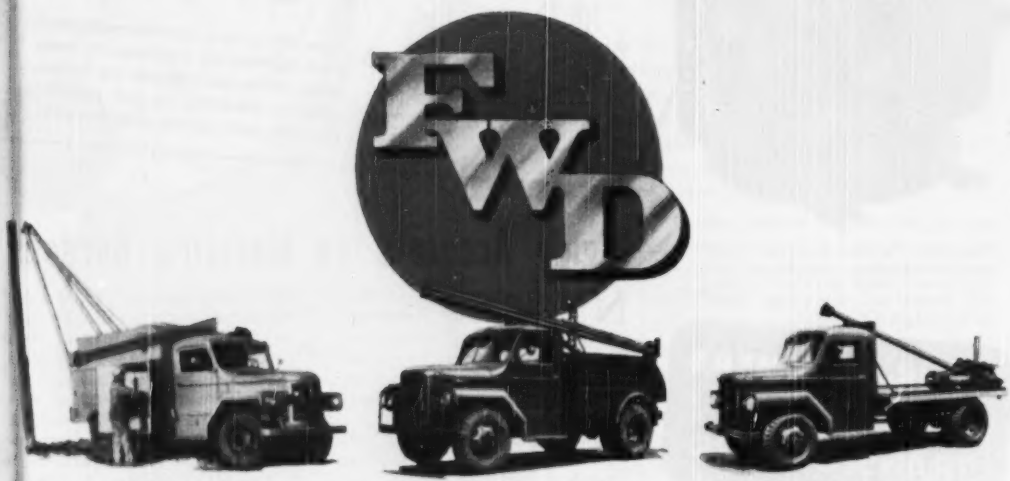
ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment from Generation through Utilization

Utility after Utility

DISCOVERS THE SUPERIORITY OF THIS

true Light-Duty Four Wheel Drive



A new LD chassis with tripod derrick and maintenance body being used off the highway.

A special utility-designed service body — one of several LD's placed in service by an eastern utility.

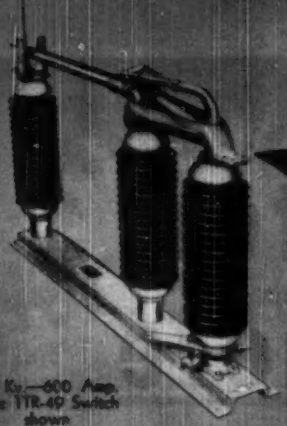
An FWD earth boring rig with full-torque power take-off mounted on the new LD chassis.

NOW . . . the new Model LD can be supplied with standardized line construction and maintenance bodies

In only a few short months, this *true* light-duty four-wheel-drive, has completely proved itself on utility applications. It has successfully filled the gap which conventional trucks and conversions have long sought to do. You'll find the LD bringing all the acknowledged FWD advantages to an entirely new FWD work range. It gives you a safe, economical opportunity to work on or off the highway — on a great variety of jobs — with small crew units. Investigate the LD today. Find out how it creates important dollar-savings and out-performs other vehicles. The Four Wheel Drive Auto Co., Clintonville, Wis., *Canadian Factory:* Kitchener, Ontario.

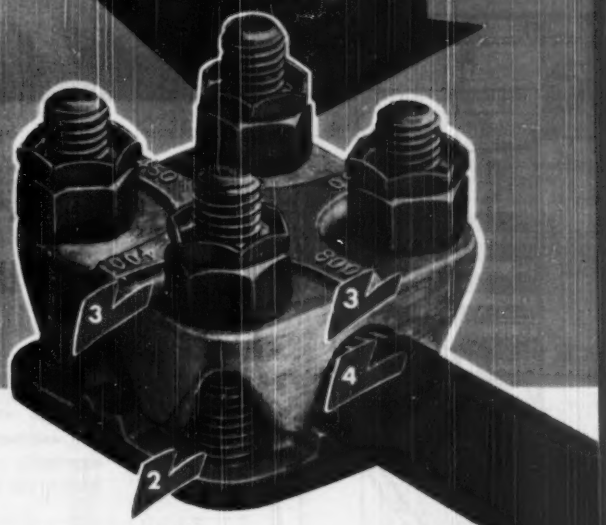
Get all the facts on the new LD — plus data on how FWD's do a real job on all types of utility applications . . . with over 40 different line construction and maintenance units. Ask for the two bulletins — "The Story of the LD" and "Get More Work Done". See Graybar or write FWD direct.

Built by the Makers of America's Foremost Heavy-Duty Trucks



R&IE UNIVERSAL TERMINAL CLAMPS

A feature found on all R&IE switches



Check the facts...

1. They combine many odd sizes of clamps for wire, cable and tubing—eliminate specifying diameters except for special conductor requirements.
2. Mounts on terminal pad with four half inch bolts on 1¾" centers.
3. Choice of clamp position doubles conductor range for each clamp. Note a 90° change in position can be made for quick selection of either of two indicated range sizes.
4. Overlapping sides of clamping cradle hold cable strands together.
5. Only three clamps cover full conductor range—Wire No. 4 to 4/0, Cable No. 4 to 800 MCM, Tubing ⅜ inch to ¾ inch.

6. Two clamps for specified conductor sizes—Cable 350 MCM to 1250 MCM, Tubing—½ inch and ¾ inch, and 1 inch.

RAILWAY and INDUSTRIAL ENGINEERING CO., Greensburg, Pa.

IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO

AN I-T-E SUBSIDIARY

DISCONNECTING SWITCHES
INDOOR AND OUTDOOR

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

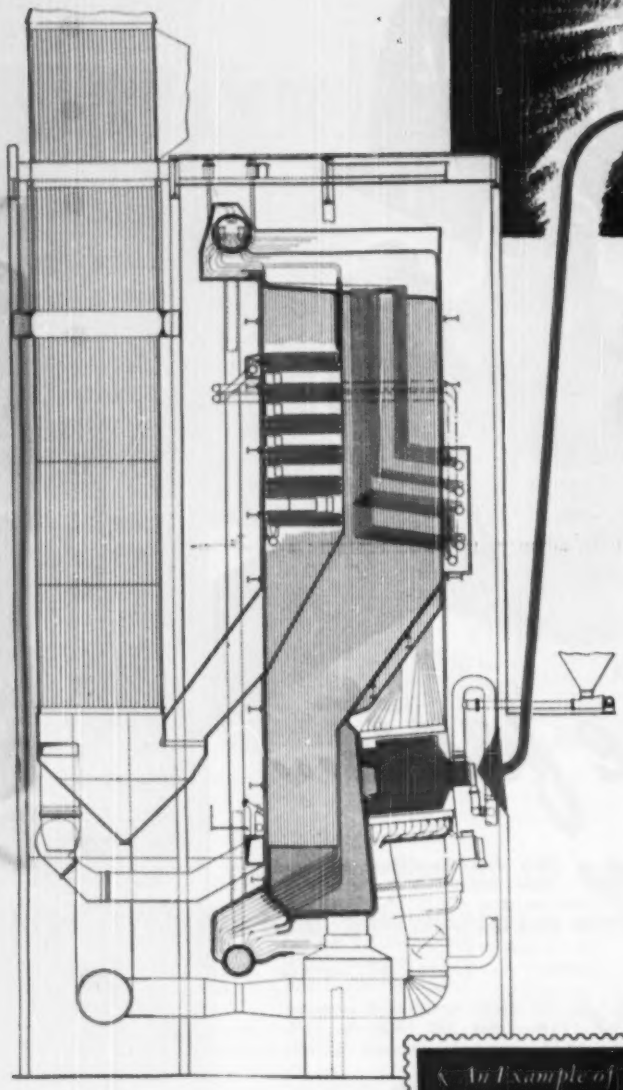
AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

Start here

with cost-saving B&W Cyclone-Furnace Boilers



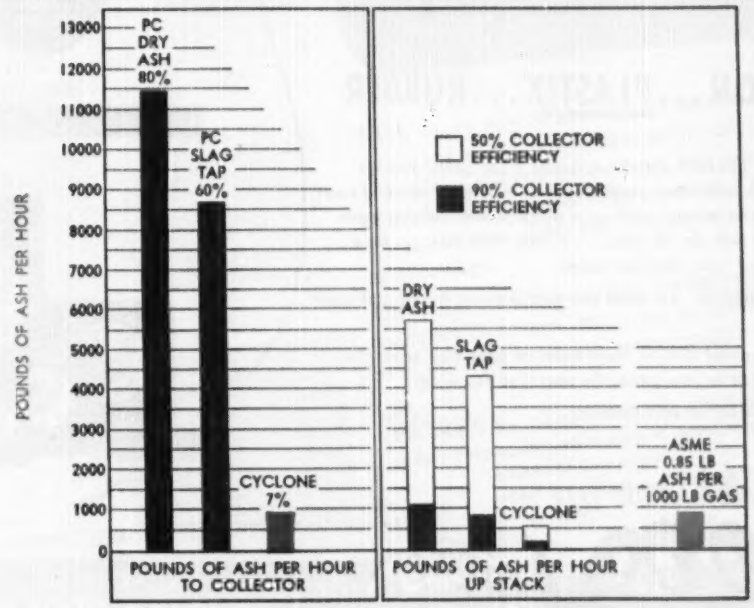
- **Savings**
  through simplification of collectors and ash-handling equipment, due to drastically reduced volume of fly-ash leaving the furnace.
- **Savings**
  through lower cost and maintenance of coal preparation equipment.
- **Savings**
  through higher boiler efficiency due to low excess air.
- **Savings**
  through reduction of boiler and building size.

An Example of B&W Engineering for Economy

for STACK DUST CONTROL

The logical place to *start* controlling fly-ash is *in the furnace*, where it is produced. B&W's unique Cyclone-Furnace recovers extremely high percentages of ash in the form of easy-to-handle slag. Your collectors handle only a small fraction of the dust-loading they would normally receive from pulverized-coal fired boilers, even those of the slag-tap furnace type. This big advantage, illustrated in a typical case study below, is only one of several that account for selection, since 1946, of Cyclone-Furnace Boilers with total steam capacity exceeding 14 million pounds per hour.

750,000 LB PER HR BOILER—16% ASH—10,000 BTU COAL—14,250 LB ASH PER HR



Helping Industry Cut Steam Costs Since 1867

BABCOCK & WILCOX

G-3147

for the Electrical Industry

not one

not two ...but all three

Dutch Brand Electrical Tapes

FRICTION ... PLASTIX ... RUBBER

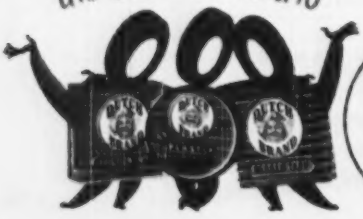
The "DUTCH BRAND" trio of electrical tapes gives you an opportunity to select the specific tapes or tape best suited to meet the requirements of your work on a performance and cost basis. No one tape will do all jobs . . . it may take one . . . or a combination of two electrical tapes.

The "DUTCH BRAND" trio gives you that selection for most efficient workmanship.

Become acquainted with all three types of tape, then select the tape most suited to your needs the next time you order.

They are available at your jobbers.

the "Dutch Brand" trio



Available in practical sizes and packaging for contractors and industrial users.

DUTCH BRAND

VAN CLEEF BROS. INC.

Manufacturers Rubber Products Est. 1910

CHICAGO 19, U. S. A.

Light the path ahead

WITH SQUARE D's NEW Low Voltage Control System

use this

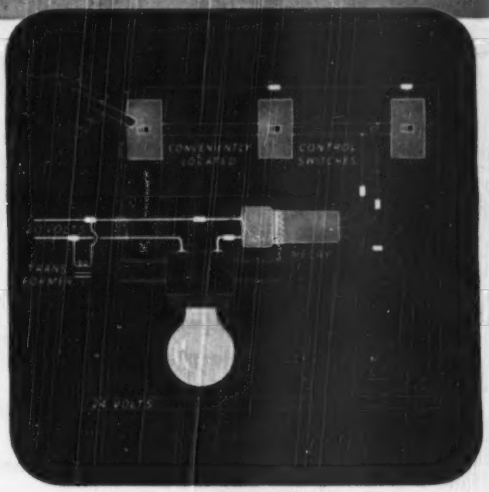
Remote Control Relay System

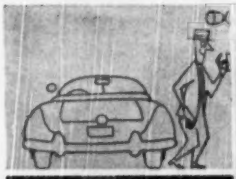
instead of conventional switching

for greater

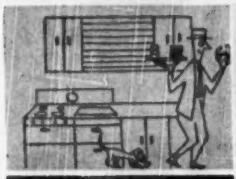
CONVENIENCE · SAFETY · COMFORT

. . . at very reasonable cost



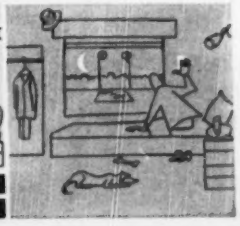


LIGHTS OFF IN GARAGE AND ON IN KITCHEN



LIGHTS OFF BEHIND AND ON AHEAD

LIGHTS ON FOR A LOOK THEN OFF ALL OVER



• The above sketch shows how remote control relays are installed in knockouts of outlet boxes. The relays are controlled from any number of conveniently located switches operating on a 24 volt system. Only the load circuit wiring is at 120 volts.

One relay can be operated by several control switches, or several relays can be operated from one or more locations, using master switches.

Write **for Bulletin No. 1008, which gives details of this simple, low-cost way to adequate switching:**

Square D Company,
6060 Rivard Street, Detroit 11, Michigan

SQUARE D COMPANY

DETROIT · MILWAUKEE · LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

No. 1 ~ a statement

★ *The following statement appears in the forepart of our Catalog:*

"The history of the Hi-Voltage Equipment Company is one of devotion to an ideal —an ideal that we will use all our craftsmanship and inventive genius to produce equipment of outstanding merit. Expense is not a primary consideration in creating Hi-Voltage switches and protective equipment. You can rest assured that each switch is designed for those who want the utmost in operating dependability."

Every illustration on these pages is evidence that we have adhered staunchly to our fundamental policy.

Because substation and switching stations seldom follow any particular pattern, the dependable Switch Manufacturer must offer many different and proved designs. The most practical and economical arrangement of bus work and connections to circuit breakers, transformers, etc., dictates the varying designs of Hi-Voltage Switches.

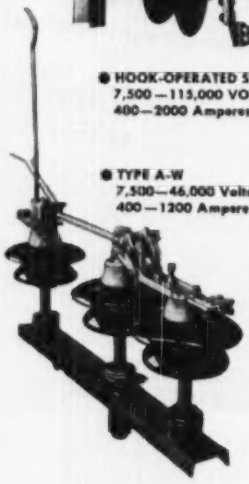
But . . . despite any variation in design . . . everyone of these Hi-Voltage Switches:

1—Has the exclusive line-type, self-aligning and self-cleaning contacts. Tests show that the life of these contacts is beyond 100,000 operations.

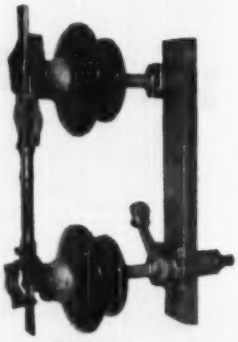
2—Reduces installation costs. The complete operating mechanism is machined at the Factory. No field drilling or cutting is required. The work done at the Factory saves hours for the construction crew.

Future advertisements in this series will discuss the merits of each type of Hi-Voltage Switch. In the meantime, let your Joslyn Representative give you the whole story.

● HOOK-OPERATED SWITCHES
7,500—115,000 VOLTS
400—2000 Amperes



● TYPE A-W
7,500—46,000 Volts
400—1200 Amperes



● TYPE D-N
Side-Opening Switch
7,500—161,000 Volts
600—1200 Amperes

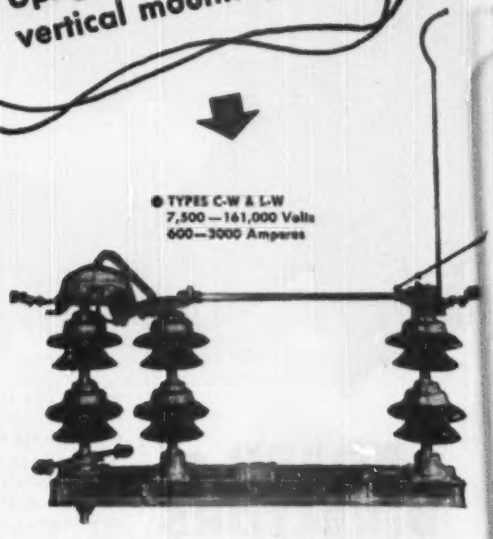
HI-VOLTAGE

# of Hi-Voltage policy

● TYPE D-C-U
Center-Break Switch
7,500—161,000 Volts
400—1200 Amperes

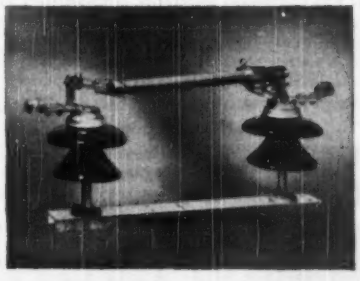
AVAILABLE!
200 to 3000 Amperes
7500 to 161,000 Volts
Upright, underhung or
vertical mounting

● TILTING INSULATOR SWITCH
7,500—34,500 Volts
200—600 Amperes



● TYPES C-W & L-W
7,500—161,000 Volts
600—3000 Amperes

● Hi-Voltage FUSES
Up to 69 kv. Available in all types of mounting up to 35,000 amperes rupturing capacity.



ALSO AVAILABLE!
Grounding Switches
Manual and Automatic Control Mechanisms
Mechanical Interlocks
Cross-arms and Mounting Frames
And all customary accessories

EQUIPMENT COMPANY

4000 EAST 116th STREET • CLEVELAND 5, OHIO

BOARD of DIRECTORS

meeting on a machine screw

Sounds like an exaggeration, doesn't it? But it's not so far-fetched when you consider that this machine screw symbolizes a whole group of fastenings that have been failing in service because of corrosion.

More or less, this happens every day in American industry. A small bolt or screw or rivet, that was never designed for use under corrosive conditions, gives way—and the whole machine, or process, grinds to a stop.

The only way to keep out of this picture is to make sure that the fastenings you use are non-ferrous or stainless steel.

Harper specializes in these Everlasting Fastenings; makes them in over 7000 different sizes, types and alloys—Brass, Bronzes, Copper, Monel and Stainless Steels; maintains large quantities in stock, ready for immediate delivery from distributors and warehouses located in principal cities.

If rust and corrosion resistance is important to you . . . if you can see the real economy in replacing common steel with fastenings that are non-magnetic, longer-lasting, reusable . . . write today for our catalog and current stock list: The H. M. Harper Company, 8205 Lehigh Avenue, Morton Grove, Ill.

HARPER

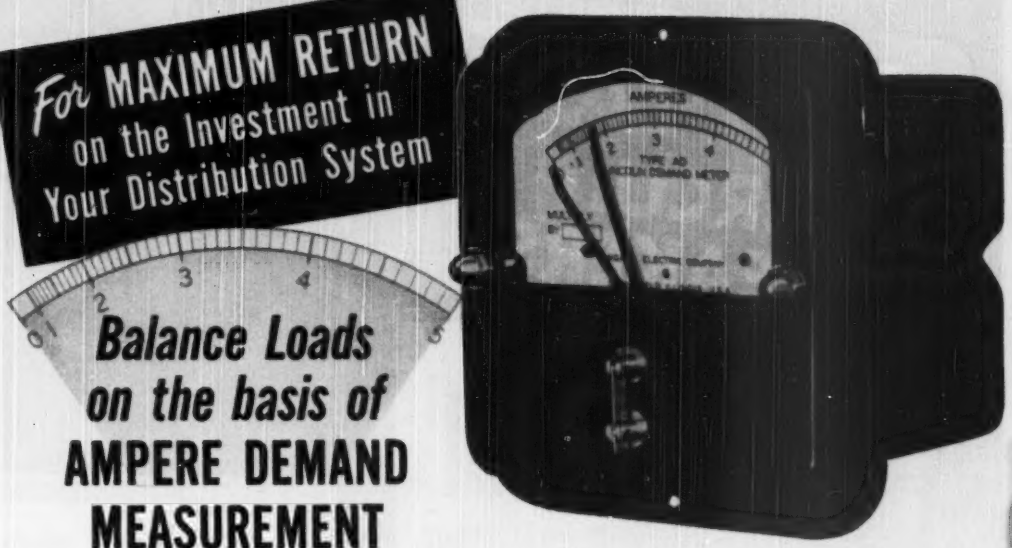
AMERICA'S LEADING SPECIALISTS

EVERLASTING FASTENINGS

IN NON-FERROUS AND STAINLESS STEEL FASTENINGS

New York Office and Warehouse: 200 Hudson St.
Los Angeles Office and Warehouse: 835 E. 31st St.
Branch Offices: Atlanta, Cambridge, Cincinnati, Cleveland, Dallas, Denver, Detroit, Grand Rapids, Milwaukee, Oakland, Philadelphia, Pittsburgh, St. Louis, Seattle, Toronto (Canada)

For MAXIMUM RETURN on the Investment in Your Distribution System



Balance Loads on the basis of AMPERE DEMAND MEASUREMENT

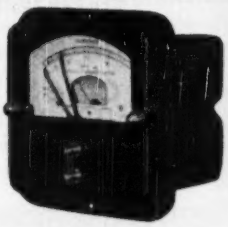
Capacity of distribution circuits depends on the heating effect of the load in amperes. You can get the most out of your distribution system by balancing the load on this basis.

Lincoln Thermal Ampere Demand Meters measure this capacity-determining factor and are particularly useful for the measurement of loading on distribution feeders. Because the indication is highly time-lagged, these meters show the value of the current which remains on the feeders long enough to affect the carrying-capacity of the lines and distribution equipment.

Where instantaneous values of current are important, Lincoln Ampere Demand Meters can be furnished with an indicating ammeter to show immediately whether the load has been picked up after an interruption.

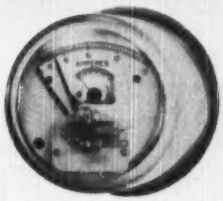
LINCOLN Ampere Demand Meters are available for Indoor and Outdoor Substations

Type AD-2



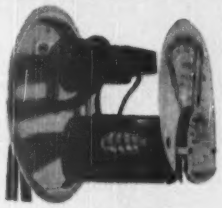
For Indoor Switchboards . . .
Semi-flush or surface mounting with or without instantaneous indicating ammeter.

Type ADS



For Outdoor Substations . . .
Standard meter-socket mounting with or without instantaneous indicating ammeter.

Type ADN

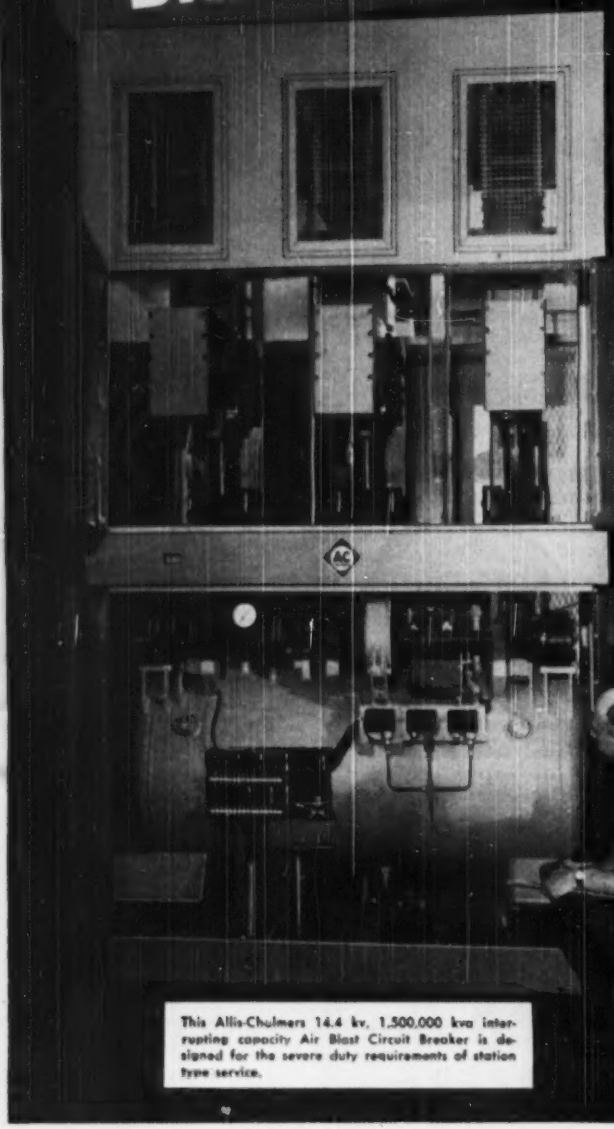


Special For "Wye" Banks
Standard meter-socket mounting. Type ADN meter has through cable for connection into "Wye" neutral leads, requiring no instrument transformers.

Lincoln Graphic Ampere Demand Meters are also available for indoor or outdoor applications. Full information is given in these bulletins: Bulletin 461 (Type AD-2 and ADS); Bulletin 467 (Type ADN); Bulletins 451 and 452 (Graphic Types).

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

AIR BLAST CIRCUIT BREAKERS



Get these Advantages in Allis-Chalmers

STATION TYPE INDOOR AIR BLAST CIRCUIT BREAKER

This Allis-Chalmers 14.4 kv, 1,500,000 kva interrupting capacity Air Blast Circuit Breaker is designed for the severe duty requirements of station type service.

Greater Safety-Low Maintenance

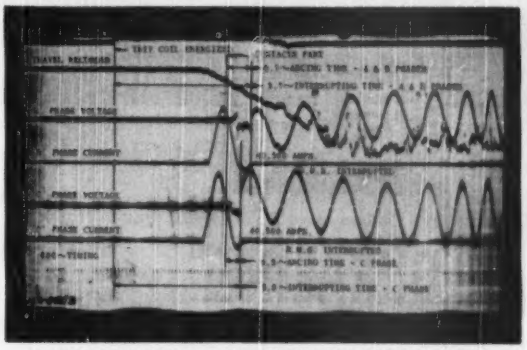
RATINGS AND PERFORMANCE FULLY PROVED by 3 phase interrupting capacity tests.

ACTUAL INTERRUPTING TIME LESS THAN 5 CYCLES . . . minimizes system disturbances, eases strain on connected equipment.

ARCING TIME ONE CYCLE OR LESS! Prestored compressed air *blasts* out arc for fast interruption.

SAFE DEPENDABLE OPERATION. Breaker is completely enclosed within grounded steel housing. Operation is electrically and pneumatically trip free.

LOW COST MAINTENANCE. Negligible contact burning because of low arcing time. Entire breaker is accessible through hinged doors.



TYPICAL OSCILLOGRAM CURVES SHOW FAST CIRCUIT INTERRUPTION AND SHORT ARCING TIME OF THE TYPE AB-15 AIR BLAST CIRCUIT BREAKER

FULLY PROVED, modern Allis-Chalmers Air Blast Circuit Breakers can be supplied in 14.4 kv ratings, up to 2,500,000 kva interrupting capacity, in accordance with the new ASA standards.

Allis-Chalmers air blast breakers are factory assembled complete with cubicle, necessary control equipment and breaker air storage tank, ready to install and operate.

For more information on the advantages of this modern, oil-less air blast power circuit breaker, contact your nearby A-C sales office. Or write direct.

A-2794

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

DURALINE

. . . at its best when weather's worst!

IT SURE WOULD BE TERRIFIC . . . if there were no such thing as bad weather. No snow, no sleet, just sunshine and clear skies.

Then most any wire would do the trick.

But, unfortunately, Mother Nature can be plenty rough on ordinary weatherproof.

Not Duraline* though! Because Duraline URC Weatherproof is built to last. Continuous interlocked fibrous sheath is thoroughly impregnated with URC saturant and finishers. Available with either copper or copperclad conductor, it is scientifically constructed to be the best insurance you can buy against moisture seepage, festooning, and service interruption due to foreign objects across the line.

We have a serious copper problem now, but it's still our job to help out on *your* problems. We'll do our level best. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Reg. U.S. Pat. Off. 50115

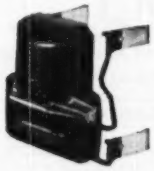
The right cable for the job **ANACONDA®** **WIRE AND CABLE**

Be thrifty—use the I-50

THERE'S LESS TO MAINTAIN!

With the I-50 watthour meter, all need for periodic replacement of bearings has been eliminated. Magnetic suspension of the rotating element eliminates all vertical pressure. Contrast this with a conventional meter, where pressure of the disk on the lower bearing is measured in tons per square inch.

Corrosion is eliminated by a combination of unit-molded base and stainless-steel cover- and socket-sealing rings. Accurately controlled relief gaps permit the I-50 to withstand voltage surges that would put an ordinary meter out of service.



Each complete electromagnet is a unit assembly, not subject to misalignment. This unit construction makes possible an economical service plan. A complete frame and electromagnet assembly can be exchanged for a rebuilt one—as a unit. Cost of the assembly is no more than the cost of just a single current coil for an older meter.

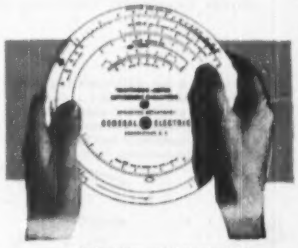
time to retire ... old watthour meters?

Meters of pre-1914 design should be retired promptly.

Meters of 1914-1925 design lose revenue at high loads, justify few or no repairs.

Meters of 1926-1936 design also require appraisal.

Now—with the aid of the retirement evaluator*—you can determine which groups of your meters are losing money and should be retired promptly. The evaluator is based on an economic formula for meter retirement developed by General Electric engineers. Ask your G-E representative for complete information. Apparatus Department, General Electric Company, Schenectady 5, N. Y.



*RETIREMENT EVALUATOR

GENERAL ELECTRIC

401-30

NEW, LARGER CRESCENT WIRE GRIP

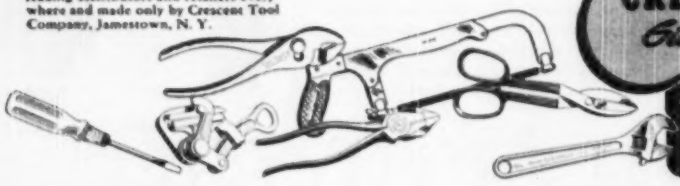
● The newest member of the Crescent line of Wire Grips offers increased Capacity and Strength. The new Crescent #386 handles wire up to 1-1/16 inches ...the illustration shows it gripping a 600,000 C. M. Conductor. Each Crescent Grip is factory tested to its full safe load. Every Crescent Grip is drop-forged and heat-treated. Crescent Grips won't slip or jam, easily released. Available in two Jaw Types...Regular with corrugated jaws for bare or insulated wire and Smooth for aluminum wire, cadmium-plated finish. Equipped with ring at top for hot line hook and special hook which prevents grip from dropping off wire. Other types of Crescent Grips are illustrated in the Crescent Catalog. Write for a copy.

GRIP CAPACITIES — LOADS — WEIGHTS

No.	Max. Cap.	Min. Cap.	Wt. Lbs.	Eye Opening	Weight
383	3/8" (.375)	5/32" (.156)	5,000 lbs.	1⅛ x 1 1/16	2 lbs.
384	7/16" (.437)	1/4" (.250)	7,500 lbs.	1⅛ x 1⅜	3⅜ lbs.
385	13/16" (.812)	3/8" (.375)	10,000 lbs.	1⅛ x 1⅜	4¾ lbs.
386	1" (1.000)	5/8" (.625)	12,500 lbs.	1⅜ x 2⅜	8½ lbs.

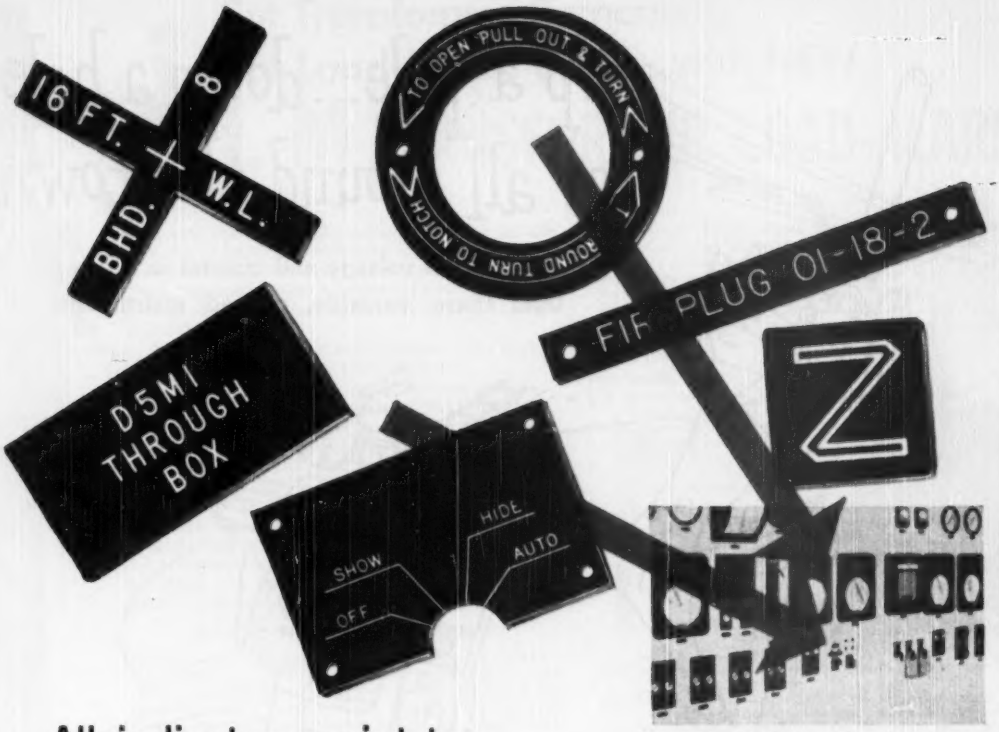
NOTE: Add -2 to catalog number if you want smooth jaw Grip for Alum...um Wire. Example 383-2.

"Crescent" is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by Crescent Tool Company, Jamestown, N. Y.



CRESCENT TOOLS
Give Wings to Work
Sign of the Artisan
Symbol of Excellence

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK



Gage boards at the Tampa Electric Company have designation plates made of LAMICOID Engraving Stock by Hirsch Engraving Company, Tampa, Fla.

All indicators point to Engraved Lamicoid®

for clear-cut, durable designation plates

You can count on engraved LAMICOID in designation plates—or in dials, instruction panels, wiring diagrams—for clear-cut legibility that lasts.

LAMICOID Engraving Stock is a sandwich-type laminated plastic. Markings engraved into the surface expose a contrasting core to make a *permanent* impression. There's no paint or filling to wear off or discolor. The hard surface and core of LAMICOID resist wear and abrasion, weathering, moisture, fumes, acids and alkalis. It's easily wiped clean with a damp cloth.

Three grades of LAMICOID, Engraving Stock, Translucent and Graphic—offer you a wide range of application for signs, dials, instruction panels, etc., either opaque or for rear illumination. See how you can save on first cost, maintenance and replacement, with LAMICOID. Contact our nearest sales office.

MICO

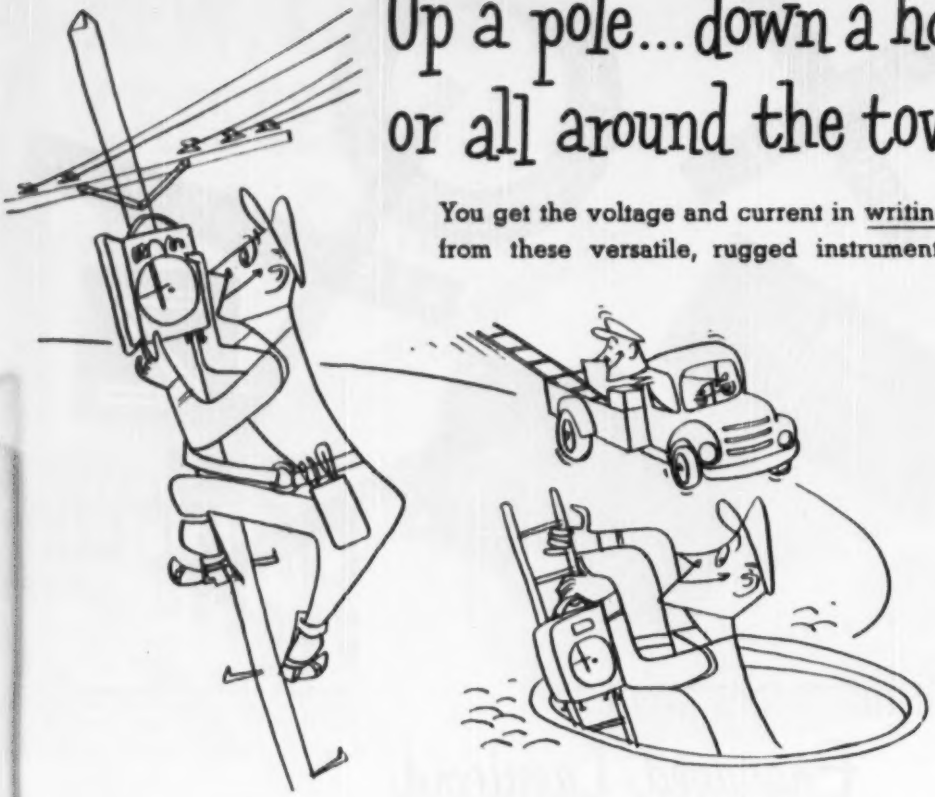
MICA Insulator COMPANY

Schenectady 1, New York

Offices in Principal Cities

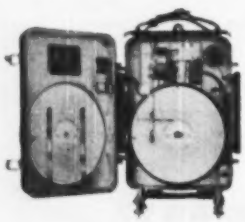
Up a pole... down a hole or all around the town

You get the voltage and current in writing from these versatile, rugged instruments



Bristol All-Purpose Recording Voltmeters and Ammeters

Lightweight and self-contained . . . all parts built for rough handling



For the most efficient operation of your electrical system, keep an eye on voltage and current.

Knowing the facts — accurate, complete, clear—you can make the necessary corrections.

Bristol's All-Purpose Recorders —with weather-proof case and light weight—handle a great variety of work . . . pole-mounted, wall-mounted (ideal for damp cellars and manholes), permanently mounted—or portable. 1, 2 or 3 pen types.

In stock for immediate delivery.

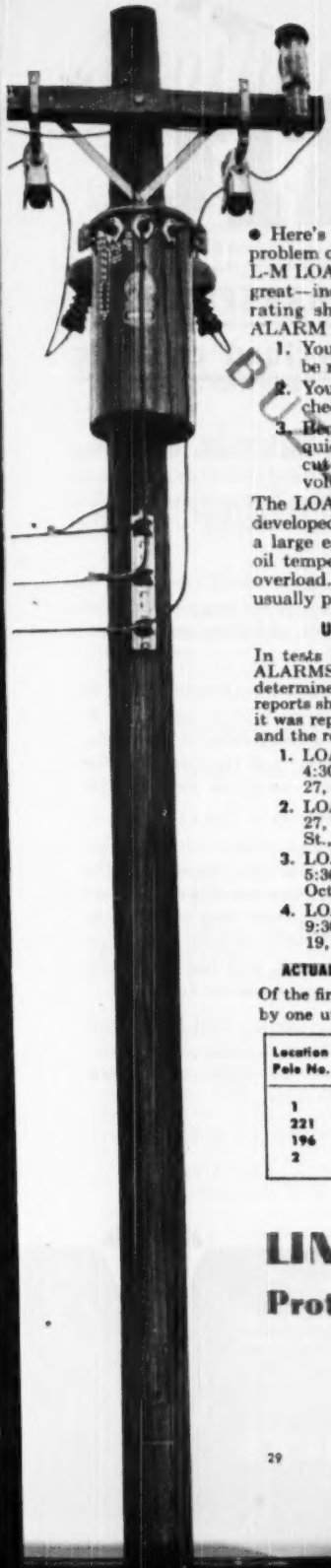
Write for Bulletin E1100. THE BRISTOL COMPANY, 116 Bristol Rd., Waterbury 20, Conn.

BRISTOL

Gives You the FACTS

When and Where You Want Them

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS



Cut Transformer Burnouts... Cut Load-Check Costs...with NEW L-M TRANSFORMER LOAD-ALARM*

● Here's the simple, economical answer to the problem of locating overloaded transformers. The L-M LOAD-ALARM signals when the load is too great—indicating that a transformer of higher kva rating should be installed. Using the LOAD-ALARM means:

1. You save transformers because they can be replaced before they burn out.
2. You eliminate the need for costly load checks to locate overloaded transformers.
3. Because overloaded transformers can be quickly located and then replaced, you cut down the number of customer low voltage complaints.

The LOAD-ALARM is a simple, thermal device developed by L-M engineers in cooperation with a large eastern utility company. It operates on oil temperature rise caused by prolonged heavy overload. It emits an audible signal which is usually promptly reported by the customers.

UTILITY MAKES TIME-CLOCK TESTS

In tests by a large eastern utility, L-M LOAD-ALARMS were set by time clock to operate at predetermined times of the day. Following are a few reports showing time the alarm began operating, time it was reported, and location of the lost transformer and the reporter's residence.

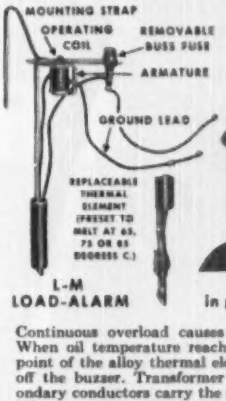
1. LOAD-ALARM at 371 Villa St., Sept. 27, 4:30 P.M. Reported from 361 Villa St., Sept. 27, 5:20 P.M.
2. LOAD-ALARM at 133 Knowlton St., Sept. 27, 5:00 P.M. Reported from 129 Knowlton St., Sept. 27, 5:08 P.M.
3. LOAD-ALARM at 61 Grosvenor, Oct. 7, 5:30 P.M. Reported from 40 Belmont St., Oct. 8, 10:00 A.M.
4. LOAD-ALARM at 105 Hickory, Oct. 17, 9:30 A.M. Reported from 111 Hickory, Oct. 19, 4:00 A.M.

ACTUAL OVERLOADS REVEALED BY LOAD-ALARMS

Of the first 15 LOAD-ALARMS put in actual service by one utility, four operated under these conditions:

Location Pole No.	ALARM Reported by	Transformer Rating	Actual Load
1	Customer	15 Kva	28 Kva
221	Employee	15 Kva	27 Kva
196	Several customers	15 Kva	29 Kva
2	Several customers	50 Kva	85 Kva

"Use of this device allows us to make greater use of our transformer capacity," says one of this utility's district superintendents. "It allows us time to make secondary surveys before changing transformers. Necessary replacements can be made during normal working hours instead of on overtime, and long interruptions and burnouts and resulting rewinding costs are eliminated."



L-M LOAD-ALARM

L-M LOAD-ALARM in position in transformer tank.

Continuous overload causes the oil temperature to rise. When oil temperature reaches the predetermined melting point of the alloy thermal element, the alloy melts, setting off the buzzer. Transformer acts as sounding board; secondary conductors carry the sound to connected structures. When customers phone (and they do!) lineman removes the fuse through the handhole, silencing the buzzer until it is convenient to make a load check and install a transformer of higher rating.

TRY IT YOURSELF!

L-M LOAD-ALARMS cost about $3.00. Order enough for a test, right now. Order from the L-M Field Engineer or direct from Line Material Co., Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

*Trademark

LINE MATERIAL

Protective Equipment

LM

Now, with ORTO*

L-M ROUND-WOUND* TRANSFORMERS give you improved overload capacity

L-M ROUND-WOUND DESIGN has always been remarkable for its balanced performance, and its outstandingly high short-time overload capacity. These advantages have been achieved without any sacrifice of other performance characteristics, through the excellent cooling.

This cooling is due to the continuously *wound* core with its cruciform shape, which provides passages for ample circulation of cooling oil, and the long *round* coils, which expose large surfaces to the oil.

Now, with ORTO (oxidation resistant transformer oil), L-M distribution transformers have even higher resistance to heat deterioration; the inhibitor greatly extends the period preceding serious oil deterioration; and the user gets the proved L-M "new transformer" overload capacity for years and years of extra service.

L-M's ORTO oil keeps cooling passages clear of sludge; prevents the formation of acids that deteriorate the cellulose insulation; prevents corrosion and rust caused by acidified oil. ORTO brand oil, now supplied in L-M transformers, was the result of long and extensive research and development, and has been fully proved in rigorous accelerated service tests.

For complete information ask the L-M Field Engineer; or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

**Trademark*

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Now available... ORTO concentrate

ORTO oil is now available in a concentrate for use in existing transformers of any make or rating. Ask for full information.

ORTO... another L-M "first"!

L-M was the first to announce the regular use of inhibited transformer oils—another example of L-M leadership in research and product improvement.

LM

LINE MATERIAL... Transformers

Complete Coordinated Equipment for Distribution Today

Another **L-M** *"first"!*

L-M was the first to announce the use of inhibited oils in its transformers, and has set the pace for the entire industry. This is another example of L-M leadership in product improvement through advanced research, development and testing.

a revolutionary new development in transformer oil

"ORTO"* brand oil is a revolutionary new inhibited oil that resists oxidation, acidification, and sludging. It lasts several times as long as a high-grade conventional oil. Therefore it offers these advantages:

1. **Improved overload capacity**
2. **Longer transformer life**
3. **Lower maintenance costs**

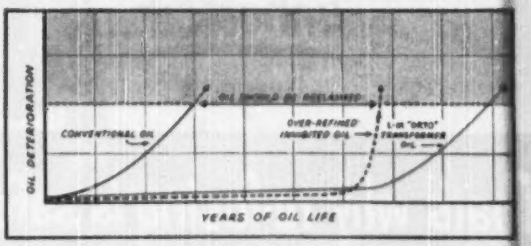
"ORTO" brand oil has been thoroughly tested. Its advantages are conservatively stated. It does not deteriorate suddenly after the inhibitor has been used up. In "ORTO" the inhibitor lasts many years. After that the oil still has inherently long life, with normal resistance and characteristics; and it then simply begins the normal rate of deterioration.

All this time "ORTO" has kept cooling oil passages clear of sludge, permitting the original unrestricted oil circulation, and maintaining the original high short-time overload capacity. By preventing the formation of acids, "ORTO" has protected cellulose insulation from deterioration, and has prevented the corrosion and rust caused by acidified oil.

"ORTO" brand oil is now available in L-M Round-Wound and other L-M distribution transformers.

Ask the L-M Field Engineer for complete information, or wire or write Transformer Sales Department, Line Material Company, Zanesville, Ohio (a McGraw Electric Company Division).

*Trademark



Comparative curves show the deterioration of transformer oil in service. A high-grade conventional oil deteriorates at a gradually accelerating rate. Over-refined oils may have a better response to the inhibitor; but once the inhibitor has been used up, the oil has little resistance to oxidation, and deteriorates rapidly. "ORTO" brand oil is a high-grade conventional oil with an inhibitor which greatly extends the beginning of the deterioration, which, when it finally starts, assumes the same gradual curve as with *any* high-grade conventional oil.

● **"ORTO" oil is now available in bulk or as a concentrate for use in your existing transformers regardless of make or rating. Ask your L-M Field Engineer for details.**

10-1-R

LINE MATERIAL... Transformers

safer!

That's why re-fusing is safer with L-M PVD Fuse Cutouts!

THE LINEMAN DOESN'T NEED TO TAKE CHANCES

when he re-fuses *Line Material* Fuse Cutouts. They're designed for safety!

The large pull ring handle plus the little hook on the flipper assembly enables him to open, unhook and remove the door completely, re-fuse and replace it (or a spare fused door, if he's in a hurry)—all with a switch stick. He doesn't get his hands anywhere near hot leads or contacts.

See how easily it's done. Get a sample and try it yourself! Then compare the many other operating and safety features of L-M Fuse Cutouts. You'll see why so many utility companies have standardized on L-M Cutouts. Ask the L-M Field Engineer for details on the full L-M line of open and closed cutouts; or write Line Material Company, Protective Equipment Division, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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LM

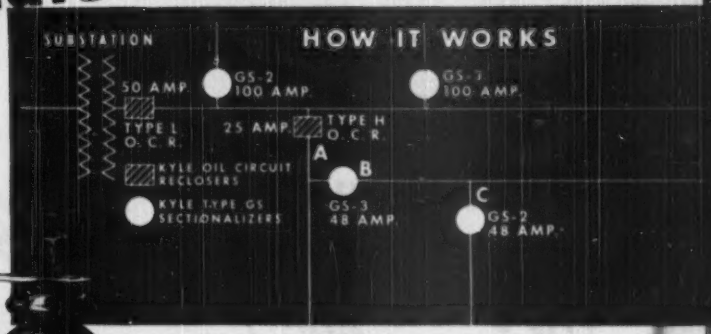
LINE MATERIAL Fuse Cutouts and Fuse Links

Complete Coordinated Equipment for Distribution Today

How to make rural line protection fully automatic...

KYLE

type GS automatic oil sectionalizers



Completely automatic from substation to branch

Sectionalizers coordinate with reclosers to isolate branch lines on permanent faults. They are not current-interrupting devices. They open only while the recloser contacts are open. They are pre-set to lock out after the first, second, or third operation of the recloser.

In the diagram, A is the recloser. B is a Kyle sectionalizer set to open during the *third* operation of the recloser (indicated by GS-3). C is set to open after the *second* operation of the recloser. If a fault occurs beyond C, recloser A operates. If the fault doesn't clear on the first operation, the recloser opens again, and Sectionalizer C opens, isolating the tap. Then the recloser re-energizes the rest of the branch.

If a fault occurs *between* B and C, Sectionalizer C does not operate. But if the fault has not cleared by the third operation of the recloser, Sectionalizer B opens, isolating that branch. The recloser then re-energizes the rest of the line.

Other branches are also protected by Kyle sectionalizers which are opened by the 50-amp type L recloser at the substation.

ALL THE KYLE SAFETY FEATURES

Tank, cover, and operating handle electrically dead. Tank may be grounded. Mechanism cooled, and insulated from tank, by transformer oil. Trip-free operating handle—cannot impart a blow to operator.

RATINGS

Seven sizes, with minimum tripping currents 8 to 100 amps to coordinate with reclosers rated from 3 to 100 amps. Maximum operating currents 150 to 2000 amps, 2.4 to 15 kv. Weight with oil about 25 pounds. Crossarm or direct pole mounting.

ISOLATES permanent faults on branch lines...

COORDINATES with any make or type of recloser...

COSTS LESS to operate than fuses...

The Kyle type GS sectionalizer opens only on permanent faults that the recloser cannot clear; it provides completely automatic protection and positive coordination by eliminating the human element in installing the correct fuse; and while the GS costs more than a single-shot cutout, it saves far more than the difference, in time and service calls.

Because sectionalizers do not interrupt current, there is no arc to wear contacts or cause oil contamination. Sectionalizers cannot be used independently, but only with reclosers—of *any* make or type.

Ratings are changed in the field by replacing the trip coil. Lockouts are pre-set by changing the lockout adjustment pin—a matter of a few minutes. After a permanent fault has been corrected, the sectionalizer is manually reset with the operating handle.

Get the Whole Story

Ask the L-M Field Engineer to explain complete, automatic protection, and to give you a copy of Sectionalizer Bulletin CR3. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

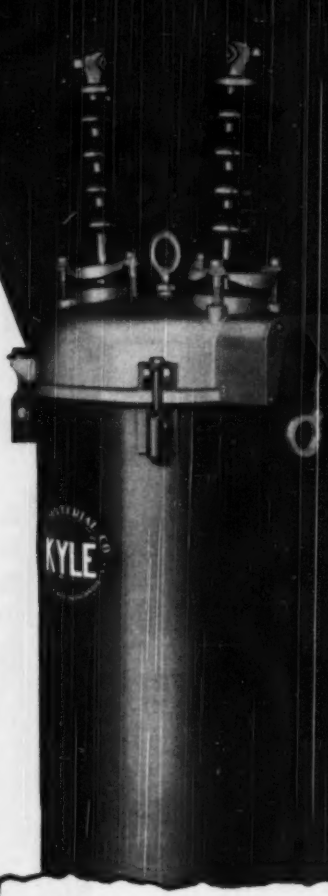
LINE MATERIAL... Kyle Sectionalizers

KYLE

TYPE "L" OIL CIRCUIT RECLOSER NOW GIVES YOU UP TO

6000 amps interrupting capacity

IN NEW 140-AMP RATING



First recloser actually engineered for heavy-duty service . . . full power-class design . . . 110 kv insulation impulse level . . . ratings up to 140 amps . . . only real heavy-duty recloser in its class

Kyle type "L" reclosers cost a little more than lighter-duty reclosers, but they're worth the difference in service, performance, convenience, and freedom from maintenance. Even if you don't need the extra interrupting capacity now, you will need it to take care of future loads; and in the meantime you enjoy all the benefits of type "L" performance and economy.

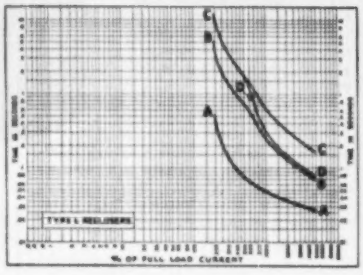
It's the Kyle oil cross-blast method of arc extinguishing, plus heavy-duty design, that makes it possible for the "L" to handle heavy fault currents up to 6000 amps.

The type "L" is the only recloser with so wide a choice of operating sequences. Four standard curves permit any sequence of operation to meet your coordination problems.

Sequence and coil changes are made right in the field—in a few minutes. To change to a coil of different rating, you just remove two screws. To change operating sequence, simply rotate a disc or change one small part. It's quick—and easy! Saves shop trips!

Extremely accurate; virtually no effect from ambient temperature changes. Positive fast operation; positive toggle closing—doesn't depend on gravity. Many safety features: cover and tank electrically dead—bushing tops only live parts; trip-free operating handle. Large sleet hood protects counter and operating handle; may be rotated in 90° steps. Rugged; shock-proof; trouble-free.

ONLY RECLOSER WITH 4 OPERATING CURVES



RATINGS

Coil Rating Amperes	Min. Trip Current Amperes	Maximum Interrupting Capacity Amperes At Maximum Phase-to-Phase Nominal Voltage of		
		4.8 kv	7.2 kv	14.4 kv
25	50	1500	1500	1500
35	70	2100	2100	2100
50	100	3000	3000	3000
70	140	4200	4000	3000
100	200	6000	4000	3000
140	280	6000	4000	3000

Read all about it!

Ask the L-M Field Engineer for a copy of Bulletin CR1A—on the type "L"; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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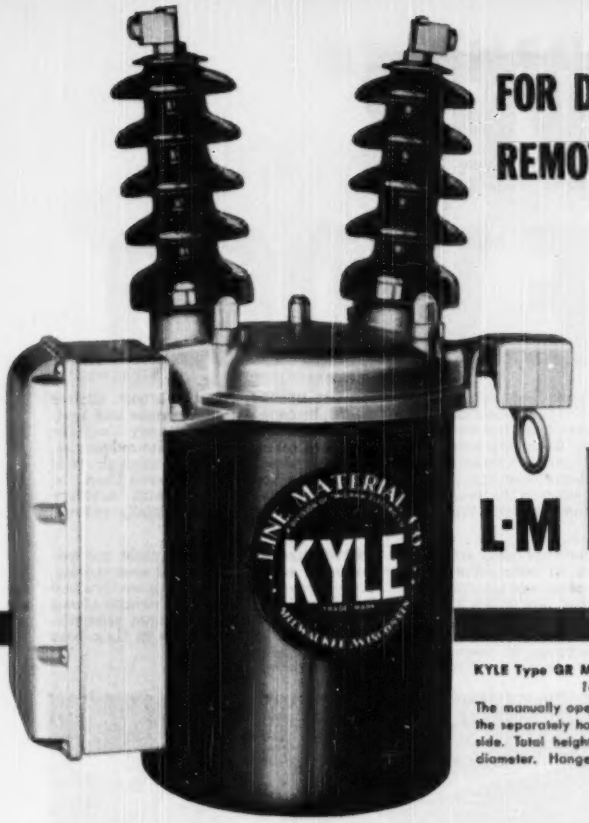
LM LINE MATERIAL . . . Kyle Reclosers

Complete Coordinated Equipment for Distribution Today

FOR DEPENDABLE MANUAL OR REMOTE CONTROL OF

capacitors . . .
street lighting . . .
airport lighting . . .
flood and other outdoor lighting . . .
sectionalizing . . .

L-M KYLE OIL SWITCHES



KYLE Type GR Motor-driven Remote-Control Oil Switch
100 amperes, 15,000 volts
The manually operated type G looks the same except for the separately housed motor-control mechanism on the left side. Total height including bushings, 18½"; tank, 7⅛" diameter. Hangers for direct pole or crossarm mounting.

● L-M's KYLE oil switches are available in manual control type G, in electric remote control type GR, and in the new three-pole manually operated types 1G, 2G, and 3G shown at right.

They are sturdy, dependable, economical; they provide many features that make them most desirable for a variety of light-duty load-break operations within their 15 kv 100 ampere rating.

KYLE switches provide fast operation. Contacts are fully open in less than a cycle. Double copper-tungsten contact tips minimize burning and pitting, assuring long life. The switches are light in weight, easy to install. Cost is moderate (G costs less than $37!); and they give long, dependable service. They are safe to use. The mechanism is insulated from the tank; head and operating handle are electrically dead. The only live parts are the top bushing terminals.

Type GR with Electric Control—The remote-control type GR has a shaded-pole 115-volt 60-cycle AC motor with control and selector switch to open or close the switch. It may also be operated manually if desired. There are no magnets requiring continuous current—the switch uses power only during actual opening and closing. Three single-phase type GR switches may be connected for simultaneous remote switching of three-phase circuits.

There's nothing to stop you from getting full information . . .

Ask the L-M Field Engineer for details and a copy of this inclusive Bulletin CR2 on oil switches; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Here's a brand-new development—the type 3G gang-operated manual control three-pole switch. Three type G's are mounted in a galvanized channel frame, and joined together with an interconnecting operating link. Shipped as a completely assembled and coordinated three-pole unit.

Operating handle, mounted directly on the pole, is connected to a length of pipe, as desired, which in turn is connected to a bell crank which operates the three switches simultaneously. Same quick-break snap action and long life as the regular G and GR. Solderless grounding lug on switch channel permits grounding entire assembly.

Also available in types 1G and 2G for simultaneous switching of single and two-phase lines.

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LINE MATERIAL Kyle Oil Switches

WHEREVER YOU USE WOOD..

IN SALT WATER, marine wood-borers give a preservative its severest test. Of hundreds of preservatives that have been tried through the years, BARRETT* *Coal-Tar* Creosote is the only one that has proved consistently effective against teredos, limnoria and other salt-water enemies of wood.

IN FRESH WATER, many preservatives leach out of wood. BARRETT Coal-Tar Creosote resists this leaching action. Being only negligibly soluble in water, it is the preferred preservative for use on submerged wood structures, or those exposed to the powerful action of rapidly flowing water.

IN THE SOUTH, prolonged high temperatures cause light-bodied preservatives to leach and evaporate from the wood, thus exposing the wood to termite attack and decay. BARRETT Coal-Tar Creosote, heavier bodied and of lower volatility, prevents this condition. It stays in the wood longer under all conditions—doesn't "run out" on the job.

IN THE SWAMPS, forces of decay are almost at their maximum of destructive power. High moisture content and infection from other decaying wood and debris are ever-present menaces. Poles properly treated with Coal-Tar Creosote have survived under swamp conditions for years.

IN THE DESERT, crossties broom, shatter and split from extreme dryness and heat. Solutions made with BARRETT Coal-Tar Creosote retard this, and also reduce mechanical wear of crossties through their lubricating action on the wood fibers. In poles, heavy treatment with BARRETT Coal-Tar Creosote substantially reduces checking and splitting.

IN THE NORTH, poles must resist the tremendous weight of frequent sleet storms. Avoid preservatives which *weaken* the wood. BARRETT Coal-Tar Creosote allows poles to retain their maximum strength, and helps to keep the poles at their best and hold the lines aloft.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Use Barrett

*Reg. U. S. Pat. Off.

Only coal-tar creosote wood preservative has been used long enough and widely enough to have proved its effectiveness under all conditions.

COAL TAR CREOSOTE

AN INSULATOR SUCCESS STORY BUILT ON INSULATOR FAILURES

If conventional transmission insulators gave no trouble, there'd be no need for a better insulator design. But the fact is that a pin-type transmission insulator is a device which leaves considerable to be desired in the way of mechanical and electrical performance.

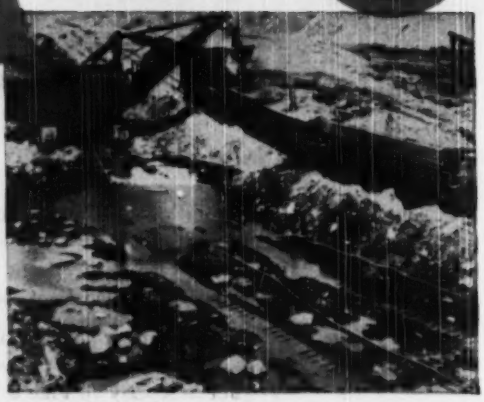
If you think that pin-type transmission insulators on your systems are serving "about as well as could be expected," you owe it to your company to take a good long careful look at your own maintenance records. We bet you'll find that the total annual cost for pin-type insulator replacements adds up to a mighty important piece of money.

The success of the Lapp Line Post insulator is built squarely on the fact that so many conventional pin-type insulators do fail, and the fact that use of this *better* insulator does cut maintenance cost in insulator replacements to a small fraction of that for conventional insulators.

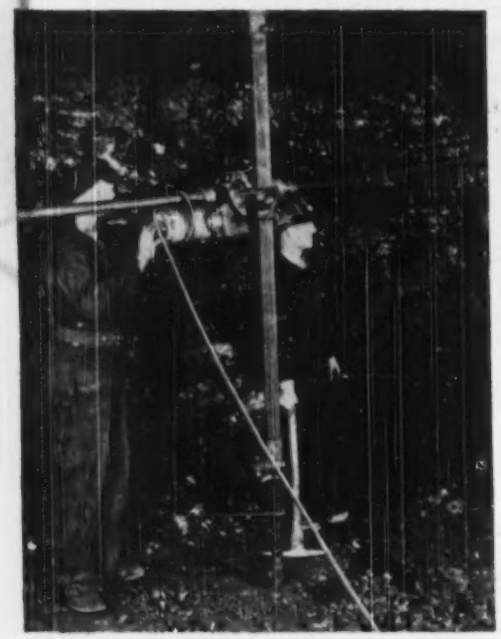
We invite you to consider Lapp Line Posts as your transmission insulator standard—on this straight dollars-and-cents basis.

JUST PLAIN TOUGH

DRAG IT OVER ROCK Many Amerclad Cables are built especially for service like this, and they're a wonderful investment in safety and trouble-free operation. Cables can be furnished with that famous American Steel & Wire Company development—PS Shielding, a conducting rubber tape that eliminates many of the disadvantages of metallic shielding . . . prevents corona discharge . . . provides a fool-proof ground circuit.

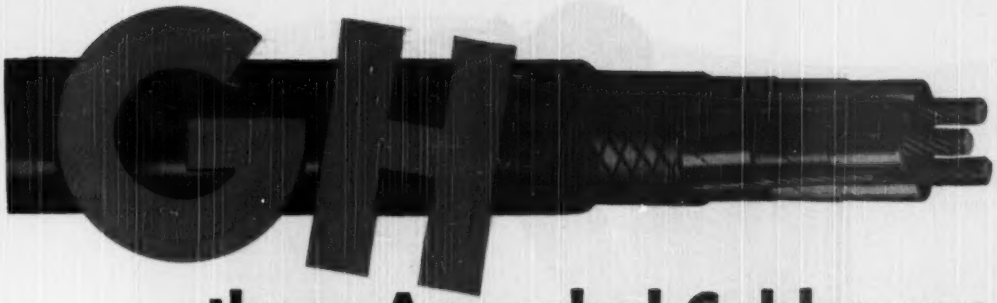


SUBMERGE IT Pit mining often means that Amerclad must be submerged in standing pools of water *besides* being dragged over sharp rock. The tough Amerprene jacket is just the thing for duty like this: it's practically impervious to moisture, earth acids and alkalies. PS Shielding gives extra protection—it clings tightly to the insulation and eliminates the gaps that cause corona discharge.



USE IT ON THE RAILROAD . . . Amerclad Railway Utility Cable does not need a canvas stocking. The flexible compound-strand-conductor is made from well-tinned and annealed copper wires—covered with a separator of paper or cotton for easy stripping. Oil-resistant Amerprene jacket means extra years of service—for generator leads, car-lighting service, train line connectors and battery jumpers.

. . . . . AND IN MINES Amerclad Cables and Cords are available for just about every mining need . . . from sweat-proof miners' lamp cord to locomotive gathering cable. Jackets are made from flame-resisting Amerprene—a tough, hard-wearing Neoprene compound that will best withstand mine acid water. We furnish cables that conform to all specifications of the Pennsylvania Department of Mines.



...these Amerclad Cables are

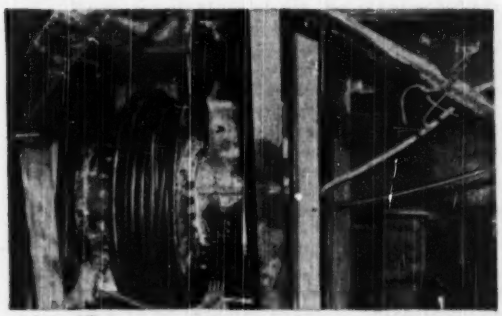
Built for Punishment

When you buy Amerclad Cable, you can *pinpoint* your needs. Chances are we can pick a standard cable, right from stock, that will fit your requirements exactly.

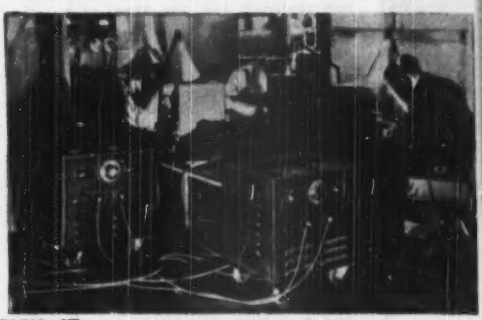
For some examples, look at the photographs on these pages. They show some mighty strenuous applications for any type of cable. But each problem was solved with Amerclad—the famous group of rubber jacketed cables manufactured by American Steel and Wire Company.

Standard insulations and jackets are available to withstand heat, oil, flame, sunlight, age and underground mining service. Moreover, you can obtain the widest range of physical construction—to meet the special conditions of industrial, general, mining and railway installations. Write today for detailed specifications.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



COIL IT The gathering reel in this picture operates continually—24 hours a day. Used in an automatic parking garage, this Amerclad Cable is constantly being coiled and uncoiled. Upstairs, it is dragged through oil and dirt that would ruin all but the very best cables. Service like this is not unusual for Amerclad Cables—they're built to withstand the worst type of mechanical abuse.



FLEX IT Amerclad Welding Cable has to meet some very special requirements. Made from a large number of very fine wires, the cable lies flat, it doesn't kink or snarl and it doesn't strain the operator's wrists while holding the electrode in an awkward position. Like other Amerclad Cables, Amerclad Welding Cable is vulcanized under pressure in a rigid lead sheath. This insures a perfectly smooth surface that resists abrasion and hard usage.

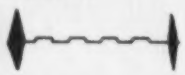
USS

AMERCLAD CABLES

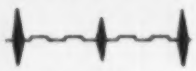
UNITED STATES STEEL

HOW IT WORKS

Supersonic waves are sent into the material under test. Upon reaching the other side, or upon reflection by a discontinuity, the waves return to their source and are then converted into a high-frequency potential. This potential is amplified by electronic circuits and projected upon the screen of a cathode-ray tube where they may be seen and examined.



Pulse pattern, showing the initial pattern at the extreme left and the reflection from the opposite side at the extreme right. The sweep line indicates no defects.



A typical indication of a defect is illustrated here. By means of calibration, it is now possible to determine both the exact position of the flaw, as well as its size.

Today, Supersonic testing is available on specification for inspecting Grinnell prefabricated piping. By observing the pattern produced by the electron beam on the fluorescent screen, any defects in the base metal, welds, or variations in pipe thickness can be located and measured at a glance.

Grinnell's ultra modern electronic testing can be relied upon to detect hidden flaws in pipe materials, to check unerringly the quality of welds where it picks up types of flaws not revealed by X-ray and gamma ray inspection. In examining bends, this type of testing can measure the degree to which bent pipe thins on the outside and thickens on the inside of the bend, assuring full specified thickness in high temperature, high pressure work.

Non-destructive Supersonic testing is another in a constant succession of new techniques employed by Grinnell to provide prefabricated piping which is safe and dependable . . . which measures up in every way to *rigid* state, national, association and insurance code requirements. It is another reason, too, why it will pay you to think of Grinnell "Whenever Piping Is Involved".

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The new Exide-Manchex Battery operates a number of 34.5 KV oil circuit breakers and provides emergency lighting in the attended substation. Indicating lamps are on each control circuit.

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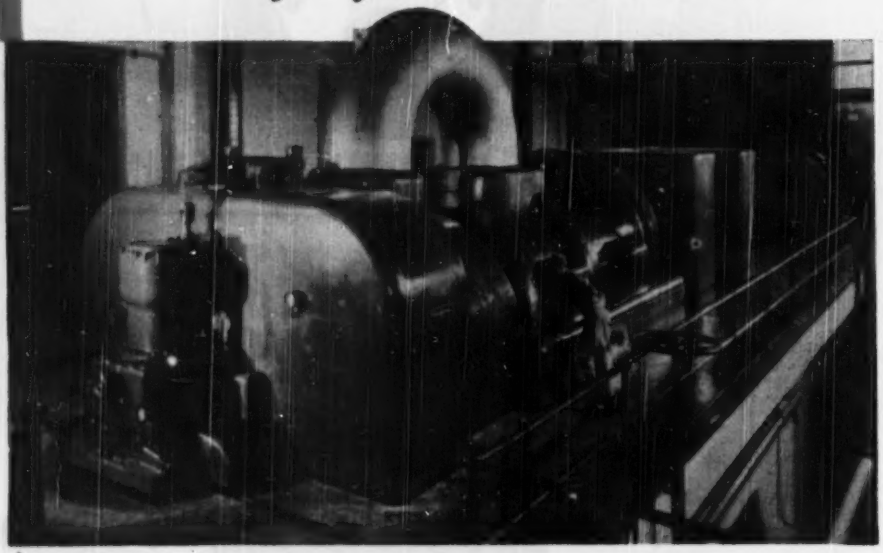

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   The neoprene jacket will not support combustion and it effectively resists deterioration by oil and heat.

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   Needing no outer metallic coverings, ANHYDREX Cables are not subject to electrolysis nor harmed by vibration, stray or secondary currents.

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America's Road to Victory

. . . Let's Increase Production

This is the time to speak out—now—at the beginning.

Our industrial program for re-armament is getting off on the wrong foot.

The talking and writing about it emphasize the wrong things.

Its headline words are "cuts" and "controls."

Those words make bad propaganda for the cold war.

"Cuts" and "controls" are no words to challenge the imagination and energy of our own people. They won't impress the masters of the Kremlin. And they can only make it appear to the rest of the world that America thinks it can defend the free way of life by abandoning it.

America stands as the world's champion against aggression because America has become the most powerful free nation in the world.

How did we get that way?

Not by putting ceilings on wages; not by rationing or clamping iron-clad government controls all over business and industry.

To be sure, some temporary controls are necessary to channel very scarce materials speedily to use for defense. So, too, are special taxes and credit restrictions needed to combat inflation. But they will be fatal if they blind us to this fact:

We became the strongest nation in the world by out-producing every other nation.

Production—The Final Answer

Next year our government is planning at least a $40 billion military program. Instead of planning only on controls to divert $40 billion of production from the making of civilian goods to the making of military supplies, we should be figuring out also ways to push up total production.

Of course, our industrial plant is running at close to "capacity" now. And our labor force has reached almost full employment. There isn't much slack to be taken up.

Can even the United States add a $40 billion miracle of production on top of what it is already doing?

Our answer is "Yes"—and within two years. It can be done by adding about $6 billion each year to our program of capital investment which now runs about $22 billion a year.

Part of this added production will come from expanding our industries. The steel companies, for example, already have plans to increase their capacity almost ten per cent in the next two years.

But by far the largest part of that $40 billion of added production must come from higher productivity—raising industry's efficiency.

continued on next page

To meet our goals we need to raise our productivity five per cent a year.

Can it be done?

The answer is an emphatic "Yes."

Raise Industry's Productivity

McGraw-Hill's studies of industry's equipment show that there are countless opportunities for improving efficiency. Our manufacturing industries alone need at least $35 billion of new equipment to raise their facilities to first class technical standards.

Here are some of the broad possibilities reported by the trained editors of McGraw-Hill's business magazines:

In many manufacturing plants as much as 40 per cent of workers' time goes into moving materials and parts—shifting things about within the plant between processes and to and from shipping platforms.

FACTORY estimates that improved materials handling equipment and methods might well cut handling costs twenty-five per cent and save annually over 650,000 man-years of unnecessary labor.

Modern machine tools designed since World War II are 40 per cent more productive, on the average, than is old equipment. But AMERICAN MACHINIST surveys show that 95 per cent of industry's machine tools are of designs at least ten years old. Replacing them could raise productivity of the metalworking industries at least ten per cent—enough to absorb a major share of the metalworking industries' part of the defense program as now planned.

In coal mining, latest equipment and methods can raise productivity sharply. The editors of COAL AGE estimate that production of bituminous coal could be raised from seven tons per man-shift to ten within three to five years.

Many new textile production techniques are 50 per cent to 75 per cent more efficient than those in use now. If plants could be fully modernized, and full use made of latest management methods, TEXTILE WORLD estimates that output-per-manhour would rise 20 per cent. *A FOOD INDUSTRIES study indicates that modern equipment plus the best management techniques could raise productivity in food processing at least 20 per cent.*

These are just some of the opportunities that industry can seize and by which the nation can profit.

A Nation-Wide Effort

Of course, industry itself can't do the whole job. Labor, government and all the rest of us must cooperate.

Government's part is to see that its emergency controls are so applied that they will increase productivity and thus make possible an early lifting of such controls.

Labor's part is to help in the development of labor-saving methods and machinery and to welcome their adoption as the only sure way of continuing to advance the American standard of living while maintaining the American free way of life.

For all of us the job is to work constantly for an expanding, ever-stronger America with constantly growing productivity; not a pinched and shackled America cooped up under wage and price ceilings and tied to a ration card.

Challenge to Industry

Here is a sharp challenge to industry to study the best work-methods that are being reported—to use every minute and every dollar it can to replace obsolete equipment.

Here is a sharp challenge to government to do everything within its power to make its control policies and its fiscal policies strengthen the incentives to industrial modernization—to demand sacrifice for a purpose and not for effect.

The job to which such opportunities point will take time—though nothing holds back adoption of some of the simpler improvements in work-methods reported in business magazines all the time.

But increasing production is our one best hope that we may be spared the full array of price, wage and production controls now and be freed eventually from all controls.

General Omar Bradley has said that the protection of our national independence calls for "long-range commitments that we are willing to carry out."

A long-range commitment to fight this battle for peace with America's most powerful weapon—industrial productivity—is the surest guarantee of victory for the free world.

Let's make that commitment—now—at the beginning.

McGraw-Hill Publishing Co., Inc.

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NATIONAL ELECTRIC...

TWO TYPES TO MEET ANY "HOT SPOT" NEED

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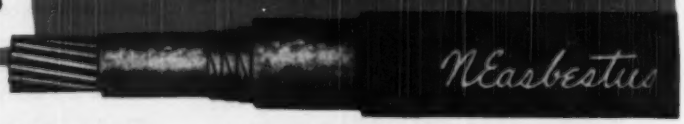

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Sizes 18 AWG to 1,000 MCM. 600-volt to 8000-volt ratings. Maximum operating temperatures up to 110° C. (230° F.) for 600-volt wire; up to 100° C. (212° F.) for 5000-volt wire.

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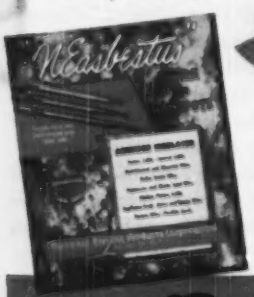

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A Serious Situation

A cut in the electric utility expansion program by at least 25% is now probable. One basis for this conclusion is the likelihood of an allocation of not more 60% to 75% of the industry's copper and aluminum requirements by the National Production Authority. There will also be shortages of steel and other metals.

One electrical manufacturer needs 3,000 tons of steel for the first quarter and has a firm allotment for only 350 tons. With an additional amount of 1,100 tons to be secured from a known source they expect to get a total of 1,450 tons or about 50% of requirements. A boiler manufacturer has planned shift operations and production on the basis of 1,000 tons of steel for February and an equal amount for March. It now appears that an allocation is being made in Washington which may well result in only 375 tons for February and 400 for March. This means 1,300 tons deficiency for the two months and would seriously curtail boiler deliveries. It is reliably reported that gas turbine production will be curtailed because of lack of columbium for civilian use.

What has created this serious problem in the supply of metal for power equipment? Certainly the need for adequate power supply is understood by everyone within and without government. Where then does the problem arise? Have the manufacturers, the utilities, or both fallen down on the job of presenting the case? Has the lack of a controlled materials plan created this situation? Perhaps all of these factors have contributed along with a shortage for all the civilian and war needs. But the utilities can go much farther than they have gone in dealing with this problem.

The adequacy of the planned expansion has been clearly presented. Organization of area staffs to watch power demands and supply is now reaching final stages. But the NPA must be sold on the essentiality for adequate allocations to complete the expansion program. Too little effort has been given to the job of assisting the manufacturers in their problems of getting sufficient material. Too little manpower has been made available to the proper Washington agencies. All in all the utilities have not yet thrown their entire weight behind the materal supply problem. They have not shown the leadership that they are capable of supplying.

There is still time to correct past errors. The industry may still get more than 75% of its requirements if sufficient effort is put in on this problem at a very early date. By the time a controlled materials plan is put into effect the essentiality of the industrys' needs can be clarified.

The utilities must immediately arrange to supply the manpower and the cooperation needed in Washington to assure completion of their expansion program.

Literature and the Engineer

Of recent years there has been a growing realization that the engineering mind should be broadened. As a class, engineers think engineering more than anything else. For their own good, but, more important, for the good of society at large, engineers should enlarge the range of their interests outside the area of their purely professional concerns.

This is the growing idea. It appears frequently in engineering society meetings and publications. The current (December) number of "Electrical Engineering" contains a piece entitled, "Obligations of the Engineer," by W. B. Kouvenhoven, expounding the theme.

Now the idea gets a kick in the pants from an authority who would never be expected so to assault it. At the annual meeting of the American Society of Mechanical Engineers this month, Professor Weller B. Embler, head of the Department of Humanities of Cooper Union, told his hearers to read what they wanted to read, not what they thought they should read.

Few persons, and certainly few engineers, have ever read Gibbon's "Decline and Fall" for the pure joy of it. It is read as a requirement in school or as an individual effort towards improvement of the mind. It is "should" reading. So are many other classics. The reading of them is a discipline, as all education is, with engineering education among the more rigorous. Why an engineer should be required to accept discipline in preparation for his professional life and be advised to reject it in preparation for other and equally important activities is difficult to understand. Particularly difficult to understand is why a professor of the humanities should offer such advice.

There are two reasons for reading books. One is for pleasure, for pastime. The other is for learning. Fortunate is the man who finds pleasure in reading books that teach him what he should know. Most of us do not, and all too quickly we lay down "The Life of Samuel Johnson" and pick up "Murder at Midnight." Certainly the engineer, to make of himself the mentally rounded person that more and more he is required to be—a duty imposed on him by the responsibility of his profession in this modern world—must do much reading of books that otherwise he would carefully avoid.

Better Coordination Needed

"There is a very definite need for better coordination between utilities and electric equipment manufacturers in their educational and promotional efforts. At the present time each group is acting somewhat independently of the other, with the result that there is no particular concentration of effort but rather a succession of spasmodic efforts requiring more time and expense than is justified by the results obtained." These are the words of an industry spokesman in the power sales field.

The sales promotion activities of electrical equipment manufacturers and utility companies would be much more effective if coordinated in terms of time and approach. Every utility as well as the manufacturers could benefit immeasurably from such a program.

The help needed in the selection of improved and better controlled processing methods for war materials and equipment based on electric power application is becoming greater day by day as the war economy is being extended into more industries. In this field coordinated efforts of power sales organizations and manufacturers' specialists could be an important factor in helping customers to improve production methods, lower manufacturing costs, and increase profits.

A manufacturer of industrial heating equipment recently said that he was furnishing "what the customer wanted." It didn't make any difference to him whether the equipment was heated with gas, electricity, oil, or coke. There may be other equipment manufacturers who have this same attitude toward electric heat. Even some sales divisions of utilities promote gas rather than electricity.

Plans to coordinate effectively a concentrated sales activity and the cooperation of all power sales organizations are greatly needed. We strongly urge that all of them start thinking and acting along these lines at the earliest possible moment.

Strong Words

The recent remarks of George N. Skoegard, President, Fresno Irrigation District, speak for themselves. Whether one agrees or disagrees, they are strong words which should promote thinking.

"The issue in the Central Valley, then, is simply whether local, democratic self-government can survive the relentless assault now being made upon it by the power-hungry bureaucrats in Washington. It is whether American citizens have a right to be consulted about their wishes and interests, or must take what Washington pleases to give them. It is our belief that if this issue were clearly understood the great majority of Americans everywhere would be on our side. The trouble is that the Bureau of Reclamation and all the other propagandists for Big Government make it their business to confuse the issue.

"For example, the people of the Central Valley are told that the interests of "all the people" demand integration and operation by the Federal government of all the Valley's water resources. That simply is not true. The interests of all the people *do* demand that this water be used in the most beneficial, economical and productive way. But that is the way it is being used now . . ."

". . . . The Kings River people know from experience that they can trust the Corps of Engineers and deal with it. They know from an entirely different kind of experience that everything the Bureau says is subject to change without notice, and that nobody can deal with the Bureau except upon that agency's own terms."

The Electrical Week

IN WASHINGTON—More TVA-type river basin developments are the major recommendation of President Truman's Water Resources Policy Commission, and in an editorial EW asserts adoption of the commission's recommendations would be another step toward nationalization of power (p 71) . . . The Southeastern Power Administration was established less than a year ago, but already it is seeking funds to build a transmission line from Buggs Island Dam to an NACA installation at Langley Field, Va. (p 72) . . . Wisconsin Michigan Power Co's wholesale rates are subject to FPC jurisdiction, an examiner has asserted (p 75) . . . And Interior Secretary Chapman has asked the State Department to replace Gail A. Hathaway of the Army Engineers as head of the U. S. delegation to international engineering meetings in India with Michael Straus of the Bureau of Reclamation (p 77).

ELSEWHERE—Preliminary figures from an EW survey indicate that the electricity supply industry will spend over $3 billion in 1951 for new construction (p 70) . . . A group of Mississippi River Basin utilities are forming a new power generating company for the purpose of building a 500,000-kw steam plant to provide power for the H-bomb plant. TVA also is planning on adding a steam plant of the same size (p 73) . . . Selling responsibilities of industrial power salesmen were stressed at a meeting of the Interstate Power Club (p 74) . . . The Pacific Coast Electrical Association held its first Hawaiian conference (p 75) . . . And for the seventeenth time in 1950 output set a new record. The 6,908,631,000-kwhr total for the week ended Dec 9 indicates that the 7-billion-kwhr week is not far away (p 77).

• • •

New construction of all kinds will drop 17.5% next year compared with this year, National Production Authority advisory committees have predicted. Biggest drop will come in residential construction due to new credit controls.

Legislation to authorize construction of the Lower Cumberland Power Dam instead of two presently authorized non-power dams (EW, Oct 30, p 5) has been introduced in Congress by Tennessee's Senator McKellar. Another McKellar bill would authorize power for Cheatham Dam, also on the Cumberland River in Kentucky.

William Glenn Sloan, Bureau of Reclamation engineer of "Sloan Plan" and "Pick-Sloan Plan" fame, was awarded a Department of Interior gold medal for distinguished service on Dec 1 at a luncheon held in North Platte, Neb.

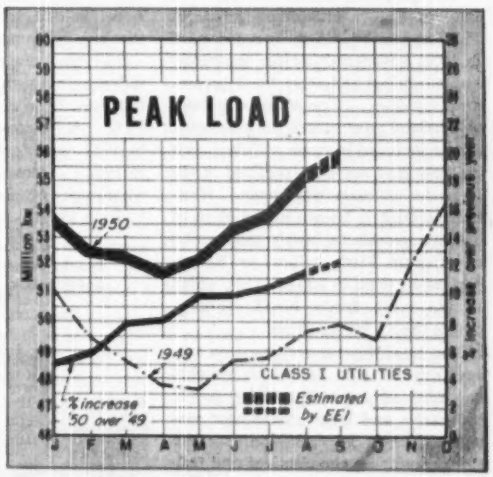
For optimism REA gets the medal. It is still limiting co-op contracts with utilities for power to five years. Because of its experience with consistently declining power costs, REA feels that longer contracts might prevent co-ops from taking advantage of new developments making possible lower wholesale rates. With all prices advancing one may easily wonder how the cost of power could decline from its present low.

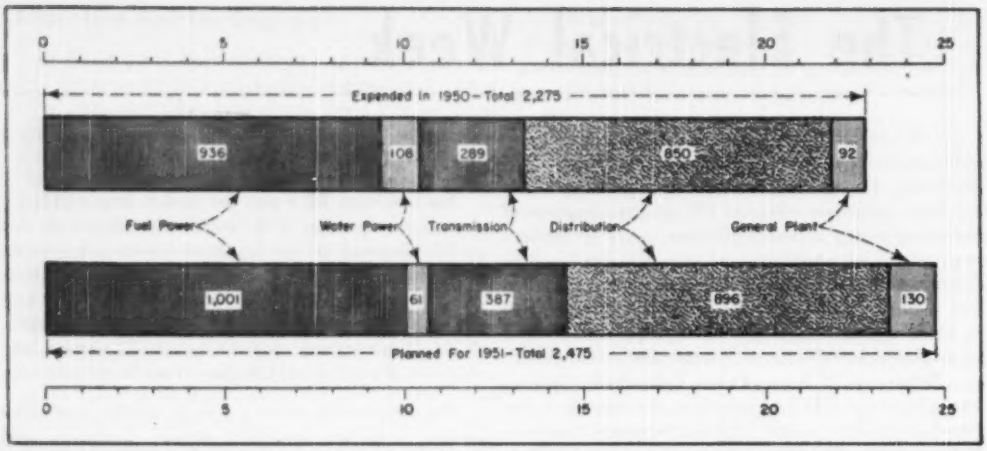
The airplane has turned out to be another emergency weapon of utilities hard hit by storms. Companies used planes to fly in line crews to help their own repair forces.

Federal power for Hawaii may be coming. Assistant Interior Secretary William E. Warne has suggested that small hydro plants might be developed there. Opening hearings in Honolulu Dec 4 on Hawaiian water development possibilities, Warne asked, "The thought of hydroelectric power developments in Hawaii is attractive, isn't it?"

During the third quarter of 1950 Pacific Gas & Electric Co connected new customers on the average of one every 4.5 minutes.

American industry is making $3 billion worth of faulty products a year, the American Society of Mechanical Engineers was told at its recent convention. The total cost exceeds the retail value of all electrical household appliances, including radios and television sets, produced in one year.





ELECTRIC UTILITIES plan to lay out close to $2500 million in new plant next year, about 10% more than in 1950

$3 Billion to Be Spent for '51 Construction

Preliminary Estimate Based on *Electrical World* Survey Indicates Little Change from 1950 in Breakdown of Expenditures by Account

Total expenditures for new construction planned by the electricity supply industry for 1951 will probably top $3 billion. This is a preliminary estimate based on summation of replies first received in Electrical World's annual survey of electric utility construction and capital expenditures.

The graph above, which shows a total of $2,475 million budgeted for 1951 against $2,275 million expended in 1950, covers only power companies and municipal and other local government utilities. Cooperative systems and federal government projects could not be included because sufficient data on them had not been received at the time the estimate was made. However, enough is known of the plans of the two groups to justify assumption of at least $500 million to be expended by them in 1951. This, added to the more firmly based estimate, makes the $3 billion figure.

The graph figures are based on survey returns that represent roughly one-third of expenditures by power companies and local government systems. These, by definition, are the electric utilities; cooperatives and federal projects are not so defined. The accompanying table shows the summations of figures from the replying utilities and the projections of them to represent all the electric utilities in the country. It is quite possible that when all returns are in and final estimates are published in Electrical World's statistical issue next month, there may appear some differences from the figures given here. But long experience in making the survey indicates that any differences will be slight.

The breakdown of expenditures to different construction accounts does not show large changes from 1950 to 1951. A little over 40% of the total in 1951 goes to fuel power plant, as in 1950. Transmission takes a somewhat larger proportion, approximately 16% in 1951 as against 13% in 1950. Distribution in 1951 is only slightly down from 1950—37% and 36%. Water power and general plant show the largest proportionate differences, but they are small items in the total.

Development of Estimates of Construction Expenditures by Electric Utilities

	1950 Expenditures		Planned for 1951	
	Totals of Returns	Estimates ($1 million)	Totals of Returns	Estimates ($1 million)
Fuel Power	353	936	379	1,001
Water Power	34	108	20	61
Transmission	111	289	150	387
Distribution	310	850	327	896
General Plant	34	92	47	130
Totals	844	2,275	923	2,475

Among the early returns were few from the larger municipal and local government utilities. Until these come in, it is impossible to estimate their expenditures separate from those of the power companies. In the summation of early returns these utilities represent less than $50 million. Their representation in the final estimate when the survey is completed will be considerably larger than is indicated by this figure.

This year, for the first time, the survey was extended to cover cooperative systems. Previously, figures on expenditures of these systems for the year ahead had been arrived at from knowledge of appropriations to the Rural Electrification Administration. Survey returns from cooperatives at the time this preliminary estimate was made showed expenditures totalling $27 million for 1950 and $21 million for 1951. The number of consumers represented by these replies is 438,000, about 14% of all served by REA systems.

Another Step Toward Nationalization of Power

An Editorial

The recommendations of the President's Water Resources Policy Commission will, if adopted, promote nationalization of the electric power industry. In very precise language they specify that, "full development of the nation's undeveloped water power resources . . . should be considered a major federal responsibility . . ." This sets the stage for more detailed specifications.

Under the recommendations a private power company could no longer develop hydroelectric sites because a federal agency like Interior has the veto power. Specifically the proposal is that, "future licenses for new non-federal water power developments should be issued only with the joint consent of the federal agencies responsible for power in basin programs."

Expansion of federal power systems with complete freedom is provided under two of the recommendations. For transmission lines the commission proposes that, "The federal power marketing policy heretofore adopted by Congress, authorizing federal agencies to build transmission facilities . . . should be continued." To permit steam plants on federal systems it says, "where the federal government assumes a major responsibility for the power supply to distribution systems, this should be recognized as a utility responsibility, requiring the construction of new generating capacity, whether hydroelectric or steam-electric."

Of course the writers of this power policy, most of whom were well indoctrinated, were smart enough to pay lip service to private power systems. They go so far as to say, "Since private power systems will probably continue to provide a large share of the new capacity required to meet future needs, federal arrangements for marketing power should take full advantage of private power facilities."

Not once in the whole report did they suggest that private power should develop a hydroelectric project or share in the energy output. In fact, the utilities would under the recommendations be forever excluded from participation in further hydroelectric developments.

In view of the testimony presented to the Water Resources Policy Commission at hearings throughout the country, it is impossible to understand the basis for the recommendations. The recommendations of the Engineers Joint Council, EEI, and NAEC have been ignored in the conclusions reached on power policy. We believe that the commission has failed to present a fair program. The proposal "that the policy embodied in the . . . recommendations be incorporated in a single statute" must be blocked.

TVA-Type River Basin Projects Get Nod from Water Policy Group

More TVA-type river basin developments are the major recommendation of President Truman's Water Resources Policy Commission. Ringing with high praise for multi-purpose, basin-wide federal water programs, the report was published Dec 18 in Washington.

The seven-man commission pointed out that the problem of administration of such programs—valley authority vs inter-agency groups or other alternatives—was outside its field of study. But the 445-page first section of the commission's three-volume findings commended TVA and declared that "the Tennessee Valley is the region in which water resources have been most completely developed and controlled."

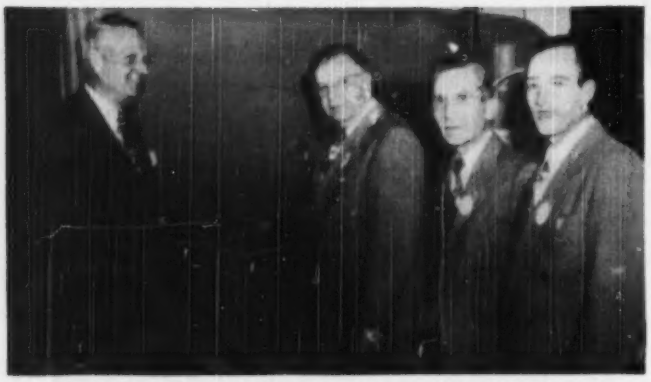
Congress, the commission asserted, should direct the responsible federal agencies to submit new proposals for water resources development to Congress as basin programs which deal with entire basins as units and which take into account water and land.

Backing federal power growth, the commission proposed a virtual ban on private hydroelectric development. "No licensing of private power projects which interfere with the full accomplishment of comprehensive multiple purpose development of river basins, including marketing of the power incident to such programs in accordance with the purpose of Congress, should be permitted," it was suggested. Private licenses, the commission explained, "would not be issued unless approved by the responsible river basin commission."

Specifically mentioned in this connection were applications of two utilities for Federal Power Commission licenses to construct projects opposed by the Department of Interior. The applications, still under consideration by the FPC, are by Pacific Gas & Electric Co for the Kings River in California and Virginia Electric & Power Co for the Roanoke Rapids site in North Carolina. A large proportion of the non-federal water power license applications before the commission are for projects "in conflict with one or another of the comprehensive federal programs," the report stated.

Members of the commission, including two former federal power officials and a public power leader are Morris L. Cooke, Philadelphia engineer and first administrator of the Rural Electrification Administration, chairman; Leland Olds, commissioner in charge of studies and formerly an FPC member and chairman, whose views have been bitterly opposed by the private electric utilities; Samuel B. Morris, Department of Water & Power, Los Angeles, past president of the American Public Power Association; Paul S. Burgess, dean of agriculture, University of Arizona; Lewis Webster Jones, president, University of Arkansas; Roland R. Renne, president, Montana State College; and Gilbert F. White, president, Haverford College.

The commission's general report,



MINNESOTA GOVERNOR, Luther Youngdahl, left, starts the 16,750-hp turbine at the Fox Lake steam generating plant of the Interstate Power Co. Assisting him, left to right, are B. F. Pickard, president of the company; C. A. Hummel, vice president; and U. C. Lindley, chief engineer at the recently completed station

"A Water Policy for the American People," will be followed by the publication next month of Vol II, "Ten Rivers in America's Future" and Vol III, "Water Resources Law." In addition, the commission will transmit to the President in January its recommendations for new water policy legislation.

The general report just issued contains a brief preview of the second volume, with sketches of four of the ten rivers to be reported on: Columbia; Rio Grande; Connecticut; and Tennessee. Other rivers "in America's future" include the Central Valley of California, Colorado, Missouri, Ohio, Alabama-Coosa, and the Potomac.

As had been forecast, the report makes a strong appeal for federal power and other water development in the Northeast. The controversial St. Lawrence River power development plus 52 other projects on the Northeastern streams "would provide a total of 1,866,000 kw of dependable power capable of supplying an average of nearly 10 billion kwhr a year delivered to load centers at not more than 0.6¢ per kwhr," it is estimated.

The report suggests three different lines of federal power policy, depending upon the power development in various regions.

Where the federal government is the main source of future power supply, "it should clearly recognize the utility obligation to assure ample supplies of power well in advance of growing regional needs." This obligation would include construction of federal steam plants as well as hydro projects. Regions seen as being in this situation include not only the Pacific Northwest and Tennessee Valley, but "it may prove desirable in northern New York and New England, where the Niagara-St. Lawrence and New England river basin developments would afford a splendid source of power supply in what is now one of the highest electric rate areas in the country."

In certain other regions, the federal government would maintain "an independent nucleus of regional transmission. . ." Steam plants, however, would be built only if private utilities were unwilling to exchange power.

In certain other regions the report says that federal transmission systems would not be necessary and that "wheeling" contracts should be entered into with private utilities.

Other power policy conclusions of the commission included:

Preference customer provisions of present federal power laws should be continued.

System-wide rate schedules should be approved for the Columbia Basin.

Provisions requiring FPC approval of rates for federal power should be repealed and an annual rate report on federal projects made by FPC to the President and Congress.

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Franchise Renewal Granted

Marcus, Iowa, has extended Iowa Public Service Co's franchise.

Sepa Line-Fund Plea Meets with Opposition

Interior's Southeastern Power Administration—established less than a year ago—already is seeking funds to construct a transmission line.

Sepa is asking $1,850,000 in a supplemental appropriation to begin construction of a $7-million line from Buggs Island Dam on the Roanoke River to the Langley Field, Va., facilities of the National Advisory Committee for Aeronautics. Langley, which has been supplied with its power requirements by the Virginia Electric & Power Co., will require 70,000 kw on-peak and 150,000 kw off-peak, presumably for wind tunnel operations.

Created early this year, Sepa markets power from dams constructed by the Corps of Engineers in the Southeastern section of the country. Buggs Island will come in during 1953, with an initial installed capacity of 108,000 kw.

Opposition Reported in House

Heated opposition to the appropriation was reported from behind the closed doors of House appropriations subcommittee sessions. Vepco officials testified that the company can continue to meet the loads of the NACA installation, either from its own system or by delivery of power from Buggs Island.

At the same time, members of the Virginia Congressional delegation were unanimously opposed to the 140-mile federal line through the State.

Plan Told in June

Plans for the Buggs Island-Langley line were first disclosed last June by Sepa Administrator B. W. Creim in testifying at the Federal Power Commission in opposition to Vepco's proposed Roanoke Rapids Development (EW, June 19, p 85).

The same supplemental appropriations measure contains a less controversial transmission line fund request. Bonneville Power Administration is asking for $1,450,000 to speed construction of the Grand Coulee-Spokane Line No. 5 and Spokane substation additions. The line speedup would require $1,070,000, while $380,000 is sought for the substation.

CROSS SYMBOL locates area in South Carolina along the Savannah River which has been selected as the site for the H-bomb plant. The location, chosen by the Atomic Energy Commission and the E. I. DuPont Co, is said to be in Aiken and Barnwell Counties near Aiken, S. C. and Augusta, Ga. According to AEC authorities, the plant would provide materials for the H-bomb but would not produce it

Utilities, TVA Act to Serve H-Bomb Plant in Lower Mississippi Basin

A giant new atomic energy plant, dubbed a second Oak Ridge, will be located in the lower Mississippi River basin.

The Atomic Energy Commission last week stoutly refused to comment on the project, but federal and private electric power suppliers were moving quickly to construct at least a million kilowatts of new electrical generating capacity for the project. A unique combine of five electric utilities, one a holding company controlling four operating companies, was forming a new $65-million electric utility to supply some 500,000 kw for a new atomic project.

Meanwhile, the Tennessee Valley Authority was seeking a supplemental appropriation for new steam facilities in the western part of its system to meet the new atomic demands. TVA's new steam capacity was expected to be on the order of its other new steam plants which will have capacities of 500,000 kw.

The new plant is expected to be the hydrogen bomb factory. AEC previously selected a site in southern South Carolina to produce H-bomb materials, but actual bomb production will not be attempted at the Savannah River location.

Speculation on the site has centered on northern Arkansas and western Kentucky. This general area is ringed by the power suppliers proposing to take care of the million-kw load.

A new power company, Electric Energy, Inc, is being formed by Union Electric Co of Missouri, St. Louis; Central Illinois Public Service Co, Springfield; Illinois Power Co, Decatur, Ill.; Kentucky Utilities Co, Lexington, Ky.; and Middle South Utilities, Inc, a New York holding company controlling Arkansas Power & Light Co, Louisiana Power & Light Co, Mississippi Power & Light Co, and New Orleans Public Service, Inc.

The five participants are seeking authorization to acquire $3.5 million of stock in the new company. Union Electric proposed to acquire 14,000 shares of $100 par common stock, Central Illinois and Illinois Power would acquire 7,000 shares each, and Kentucky and Middle South, 3,500 shares each.

Total financing is estimated at $65 million, with $61.5 million to be borrowed from two institutional investors.

Despite AEC's silence, formal news of the new project's power problems came in applications by the utilities to regulatory bodies for permission to form the new company, plus the guarded confirmation by TVA that $59 million of a proposed $84-million supplemental appropriation would be used for steam power for the new AEC installation.

In an application to the Securities and Exchange Comission, the companies proposing to form Electric Energy, Inc, said that AEC "is constructing a new project and will require at its site power in a large amount which is not now available. In order to assist in supplying a substantial portion of this power, the companies have been invited to make, and are making, a proposal to AEC."

The power companies declared that "the AEC has stated that this project, including the electric power facilities for such project, involves the greatest urgency and has emphasized that in the interest of national defense the greatest possible expedition is necessary."

The new private power generating facilities would be constructed at or near the unannounced site of the new plant and would be interconnected with the five private power systems to provide substantial standby and emergency power.

Details of the contract between the new utility and AEC "are being negotiated."

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Big Fuel Tank Collapses

A huge fuel tank at the Arkansas Power & Light Co's Lynch Plant collapsed recently, spilling $100,000 worth of oil. The tank, 40 ft high and 100 ft in diameter, held 2 million gal.

OFFICERS AND SPEAKERS of the Interstate Power Club are, left to right, Director Fred I. Smith, Jersey Central Power & Light Co; E. L. Gerber, a speaker, Atlantic Area Development Council; Chairman Frank Auchy, Philadelphia Electric Co; Secretary-Treasurer W. P. Graham, Philadelphia Electric Co; and Vice Chairman S. L. Chapin, Public Service Electric & Gas Co. In bottom panel are Paul W. Emler, a speaker, American Gas & Electric Service Corp; Robin S. Kersh, a speaker, Westinghouse Electric Corp; Retiring Chairman John B. Taylor, Atlantic City Electric Co; and Clarence T. Shoch, Nominating Committee, Pennsylvania Power & Light Co

Responsibilities of Industrial Power Salesmen Told to Interstate Club

"We still need to sell industry the advantages of electricity over other forms of energy." And sometimes we must sell new methods and equipment to prevent abandonment or removal of plants. These were the selling obligations of industrial power salesmen stressed by Robin R. Kersh, Westinghouse Electric Corp, to the Interstate Power Club Dec 11 at New York.

Even if we have an all-out war, the commercial men must be ready to serve industry and the war effort by solving application problems, coordinating equipment deliveries with construction schedules, and supplying the commercial technical information necessary for the conduct of business on a wartime basis.

Our nation has never been so well prepared to face an uncertain future, Kersh said. We are strong today because in the past five years American industry has poured some $115 billion into new and improved plants.

The industrial field offers equal and more diverse opportunities for the economic utilization of the heat pump than the warming and cooling of homes and office buildings, according to Paul W. Emler, American Gas & Electric Service Corp. He said that the practicability of the heat pump installation is enhanced manyfold where the two operations of refrigeration and low temperature heating can be performed simultaneously. All processes or manufacturing industries which require refrigeration and heating should be carefully scrutinized to determine the feasibility of the dual-purpose arrangement.

At the Goodyear Tire & Rubber Co., Akron, battery-powered industrial trucks reduced handling costs in one operation from 18¢ per unit load of 1,500-lb to 11¢—a total saving of about $30,000 a year, according to W. van C. Brandt, Electrical Industrial Truck Association, Philadelphia. He said that two trucks in use in one warehouse of the Colgate Palmolive Peet Co., Jersey City, have accounted for a saving of about $25,000 a year in labor costs alone. An industrial truck in the paper storage warehouse annex of the Carson Street Freight House of the Pittsburgh & Lake Erie Railroad, Pittsburgh, paid for itself in three months in savings on labor-handling costs, he reported.

E. L. Gerber, Atlantic Area Development Council, Atlantic City, N. J., told the group of his organized program of industrial development of Atlantic County. He said that the power salesmen of the electric utility composed the only group that knew the answers to the 50 or 60 questions relating to building in the area.

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Arkansas P&L Denied Right to Serve Company

The Public Service Commission has ruled that Arkansas Power & Light Co has no right to take over the job of providing power to a shoe company in Newport which is now being served by the Farmers Electric Cooperative, Jackson County.

The case grew out of a petition filed by the shoe firm asking the PSC to deny the co-op the right to serve on the grounds that the extension of Newport's city boundaries to include the company ruled out cooperative service. The PSC has held in the past that cooperatives must serve rural areas, and Arkansas P&L must serve towns.

However, the commission ruled that since the co-op started service to the shoe company before its annexation into Newport city limits and had established an investment it should be allowed to continue the service.

OFFICIALS at the first Hawaiian conference of the Pacific Coast Electrical Association included, left to right, H. P. Field, vice president and commercial manager, L. A. Hicks, president, Hawaiian Electric Co, and Frank Tracy, president, Sierra Pacific Power Co. Hicks is vice president and Tracy is president of PCEA

PCEA Hawaiian Parley Stresses Economic Education of Employees

Economic illiteracy of employees and the public is the greatest peril facing American business today, W. V. Merrihue, manager of employee and community relations, Apparatus Division, General Electric Co, told the 325 islanders attending the first Hawaiian conference of the Pacific Coast Electrical Association in Honolulu Nov 30.

According to Merrihue, General Electric has trained 9,000 supervisors and professional people in basic economics and is starting on a program to train 175,000 workers. The company is using the DuPont "How Our Business System Operates" course of instruction in building up a favorable economic climate in its organization.

C. W. Williams, principal electrical engineer, Hawaiian Electric Co, described two low-cost, underground distribution system for Honolulu residential districts where costs of $6.10 and $5.35 per underground lineal ft were obtained with underground overhead cost ratios of 5.4 and 2.2 respectively. Neoprene jacketed cables have been used to eliminate failures caused by termites attacking non-leaded conductors.

Industry tendencies toward smugness and complacency, based upon good service and good operating records alone, were decried by Henry Sargent, president, Central Arizona Light & Power Co. Constant work at the company and community levels, coordinated with the industry's national programs, is needed to build good public relations on a sound basis, he said.

Several noteworthy territorial cooperative sales accomplishments were listed by various speakers. Included were the 2,700-kwhr average annual residential consumption stemming from work by a large and competent home service staff and fixture allowances of $100 for an average home and $300-$400 for larger, architect-designed homes resulting from intensified home lighting sales work.

A course in canine psychology is an essential part of the training program of meter readers in a region where every home has at least one dog, David M. Moncrief, Jr, general commercial supervisor, Hawaiian Electric Co, stated. Collection problems with weekly-paid plantation workers have been simplified on the island of Kauai by placing locked strong boxes in stores in which customers can deposit payments in specially provided envelopes.

An outstanding feature of the conference was the dedication of Unit No. 2, a 40,000-kw unit in Hawaiian Electric's Waiau Plant at Pearl Harbor.

FPC Claims Jurisdiction in Wholesale Rate Issue

Wisconsin Michigan Power Co's wholesale rates are subject to Federal Power Commission jurisdiction, an FPC examiner has asserted.

Examiner Emery J. Woodall would require the company to file with the commission within 90 days all rate schedules for wholesale operations in Wisconsin and Michigan. FPC issued a show cause order last February. The company, the Wisconsin Public Service Commission, and the State of Wisconsin have contended that the sales at wholesale were not subject to FPC's jurisdiction.

Wisconsin Michigan operates in both states with two operating divisions but an integrated system. It sells power at wholesale in Wisconsin to Wisconsin Public Service Corp, Upper Peninsula Power Co, Oconto Electric Cooperative, and the cities of Kaukauna, Shawano, New London, and Clintonville. The company had argued that power transmitted from Michigan into Wisconsin lost its interstate character when it became mingled with power generated in Wisconsin and that any FPC jurisdiction is limited to that portion of the energy sold that is generated in Michigan and sold at wholesale in Wisconsin. It also claimed that deliveries to wholesale customers were made over lines used in local distribution.

Woodall ruled that integration of the system made interstate and intrastate energy "indistinguishably commingled." Where interstate and intrastate commerce cannot be separated, he said, "federal authority under the federal Constitution is dominant and controlling."

TVA, Workers Sign Pact

The Tennessee Valley Authority has signed a labor agreement covering 5,000 of its "white-collar" employees. The agreement, believed to be the first contract signed by a government agency and professional or office workers groups, covers policies on collective bargaining, work, schedules, and pay. It was negotiated with the Salary Policy Employee Board, which includes representatives of four AFL unions and two independent professional associations.

YIELDS (%) — Operating Electric Utility Securities

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE 1950									
Dec. 7	2.67	2.69	2.79	3.83	4.13	4.48	5.99	6.94	7.81
Nov. 30	2.66	2.69	2.79	3.81	4.09	4.48	5.93	6.75	7.60
END OF QTR.									
3rd 1950	2.66	2.67	2.76	3.81	4.08	4.46	5.70	6.54	7.55
2nd 1950	2.68	2.66	2.74	3.79	4.03	4.38	5.38	6.51	7.50
1st 1950	2.59	2.61	2.74	3.78	4.01	4.36	5.22	5.85	6.67
4th 1949	2.59	2.61	2.79	3.85	4.06	4.46	5.37	6.15	7.01

Data: Reis & Chandler, Inc.

September Revenues Up but Net Is Below 1949

September utility operating revenues were 10.7% above September, 1949, the Federal Power Commission reports.

Electric operating revenues of the larger privately owned electric utilities in the United States reached $404,504,000 in September, 1950, compared to $365,474,000 in September, 1949. But revenue deductions (including operating expenses, depreciation, and taxes) amounted to $331,256,000, or 14.7% over those for the corresponding month last year.

Gross income, including other utility operating income, totaled $79,861,000, a decrease of 10% for the month. Net income was down 14% to $56,974,000 from the $66,252,000 reported for September, 1949.

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Utility Will Pay 2 Cities Extra Post-merger Taxes

Public Service Co of Northern Illinois plans to act as a five-year Santa Claus to two small cities in its area, Lockport and Dixon, Ill.

When Western United Gas & Electric Co, Lockport, and Illinois Northern Utilities Co, Dixon, are consolidated into the parent Public Service (EW, Nov 27, p 19), head offices of the combined system will be in Chicago and corporation taxes will be paid there. Under Illinois law a corporation pays tax on its capital stock in the community in which it maintains its head office.

Loss of these taxes would be a blow to Lockport and Dixon. Lockport High School, for example, has received 25% of its support from Western United taxes and Chaney grade school district in Lockport township 69% of its income.

So in an unusual offer Public Service has offered to cushion this blow by paying a series of gifts to each community. The first year it will pay all the lost taxes, the second year 80%, the third year 69%, the fourth year 40%, and the fifth year 20%. This will give the two cities time in which to realign their tax requirements.

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BPA Power Revenues Hit Record in Fiscal 1950

Power sales revenue of Bonneville Power Administration in fiscal 1950 reached a record high of $31,197,515, according to Administrator Paul J. Raver. Net revenue for the year ended June 30 was $11,908,967, an increase of 12% over the fiscal year 1949.

Biggest customer was the aluminum industry, which accounted for 30% of the revenue. Next came public utilities, 27%, followed by private utilities, 24%; other industries, 9%; and miscellaneous revenues, 1%.

This brings accumulated net earnings of the federal government's Columbia River power system to $54,644,061. Federal investment in the power projects of the system as of June 30 was listed in the report as $521,766,747. As of the same date repayments of $178,792,527 had been made.

FINANCIAL BRIEFS

Georgia Power & Light Co has been ordered to lower its rates to residential and commercial customers by about 10%, effective Jan 1. The Georgia Public Service Commission issued the order after six months of study. The reduction, which will amount to about $158,000 annually, will balance a cut in the rates charged Georgia P&L by its parent, Florida Power Corp, which followed a Federal Power Commission investigation.

A court order has set aside a $1,160,000 rate increase granted Consumers Power Co by the Michigan Public Service Commission. If sustained, the court's position will necessitate a rebate of between $1.5 million and $2 million to gas and electricity customers. Circuit Judge Marvin Salmon said the decision was on the grounds that the rate boost was "unlawful, not unreasonable."

Alabama cannot tax utilities at a higher rate than other taxpayers, the state Supreme Court has ruled. The decision was handed down in a suit filed by Alabama Power Co. The state revenue department had raised the assessment of some 18 utilities and railroads from 40% of their property value to 60%.

Ravalli County Electric Cooperative, Inc, Corvallis, Mont, has cut electric rates about 12%. Rates to farm and residential, commercial and industrial, and irrigation users will be affected. The co-op's revenues will be reduced about $7,600 a year.

Electric Utility Financing—December 2-9

Company	Description	Amount of Offering (000)	Offering Price	Yield at Price to Public
Bonds				
Central Illinois Public Service	debentures 2¾%, 1970 new money	$ 6,000	100.00%	2.875%
Southwestern Gas & Electric	2½%, 1980 new money	6,000	100.50	2.85
Union Electric of Missouri	2¾%, 1980 new money	25,000	102.542	2.75
Common Stock				
Minnesota Power & Light	150,000 sh new money	4,275	$28.50	7.72
Western Light & Telephone	14,870 sh new money	297	20.00	10.00
SCHEDULED				
Bonds—Metropolitan Edison, refunding and new money, $3,250,000. Preferred Stock—Metropolitan Edison, 20,000 sh $100-par new money, $2 million.				

Chapman, Army Engineers Differ on Delegation Head

Internecine warfare between the Department of the Interior and the Army Engineers broke out again in a particularly petty way last week. Interior Secretary Chapman has asked the Department of State to replace Gail A. Hathaway, president-elect of the American Society of Civil Engineers and special assistant to the Chief of Engineers, as head of the U. S. delegation to the international engineering meetings to be held in India Jan 3-15.

As a substitute, Chapman urges Michael W. Straus, commissioner of the Bureau of Reclamation. The Secretary contends that a civilian engineer connected with the military establishment is not a proper choice to head the official delegation from this country.

Since Chapman is close to President Truman, the State Department cannot brush off his requests. However, at this late date it would be difficult for the department to make a change without risking resignations from the official U. S. delegation and criticism from the country's professional engineering groups.

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Western Oregon City Planning Hydro Project

Application for a preliminary permit for a hydro project in the McKenzie River area in western Oregon has been filed with the Federal Power Commission by the City of Eugene, Ore. The proposed project would include five power plants with a total capacity of 120,000 kw horsepower generation.

Plans include a diversion dam at Beaver Marsh with a conduit running to a 39,000-kw generating station near the mouth of King Creek. Control works wil regulate Fish Lake and Clear Lake, with a conduit to a 15,000-kw powerhouse. A 150-ft high dam at the confluence of Smith and McKenzie River will provide for an 18,000-kw generator, with a 150-ft dam on Deer Creek providing for 22,000-kw generation, and a dam on Frissell Creek with a two-mile conduit below Belknap Springs generating 27,000 kw.

The proposal also includes transmission lines from the powerhouses to a switching station at the Frissell Plant and a 60-mile transmission line to Eugene. The plants would be located on the west slope of the Cascade range.

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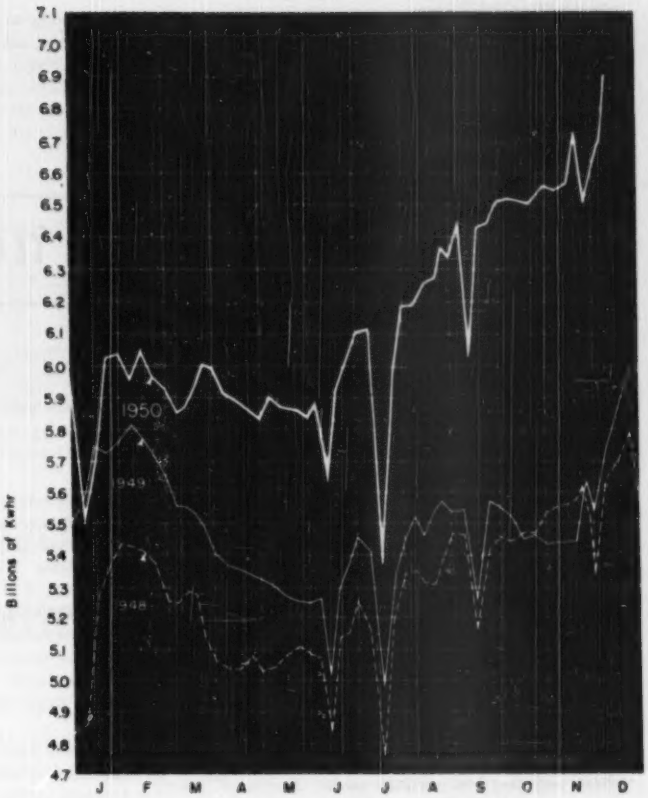
FPC Promotes Heckman

Loring E. Heckman, head of the gas resources section of the Federal Power Commission's Division of Gas Certificates, has been promoted to chief of the division. Heckman succeeds James V. O'Connor, who resigned effective Dec 8 to enter private practice.



Output Week Ended Dec 9—6,908,631,000 Kwhr

Weekly Output, Millions Kwhr								
1950		1949		1948				
Dec 9	6,909	Dec 10	5,881	Dec 11	5,705			
Dec 2	6,716	Dec 3	5,743	Dec 4	5,646			
Nov 25	6,508	Nov 26	5,537	Nov 27	5,349			
Nov 18	6,728	Nov 19	5,644	Nov 20	5,627			
Nov 11	6,574	Nov 12	5,435	Nov 13	5,571			
Nov 4	6,551	Nov 5	5,435	Nov 6	5,564			
Oct 28	6,563	Oct 29	5,433	Oct 30	5,555			
Oct 21	6,503	Oct 22	5,430	Oct 23	5,539			
Oct 14	6,509	Oct 15	5,481	Oct 16	5,482			
Oct 7	6,514	Oct 8	5,450	Oct 9	5,482			

Percent Change from Previous Year			
	Dec 9	Dec 2	Nov 25
New England	+10.0	+ 8.1	+11.9
Mid-Atlantic	+13.6	+10.6	+13.1
Central Industrial	+18.9	+17.7	+19.9
West Central	+15.8	+16.6	+14.8
Southeast	+26.2	+27.0	+22.5
South Central	+17.9	+18.7	+23.8
Rocky Mountain	+14.2	+13.2	+13.9
Pacific Coast	+14.6	+16.2	+15.3
Total United States	+17.5	+16.9	+17.5

MEETINGS

American Institute of Electrical Engineers
High Frequency Measurements Conference, sponsored with the Institute of Radio Engineers and the National Bureau of Standards, Statler Hotel, Washington, D. C., January 10-12; Winter General Meeting, Statler Hotel, New York, January 22-26.

Pennsylvania Electric Association
Winter Meeting, Transmission and Distribution Committee, William Penn Hotel, Pittsburgh, February 1-2.

Missouri Valley Electric Association
Industrial and Commercial Sales Conference, President Hotel, Kansas City, Missouri, February 8-9.

Adequate Wiring Bureau
Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, February 15-16.

North Central Electrical Association
Electrical Industries Convention, Nicollet Hotel, Minneapolis, February 25-28.

WASHINGTON COMMENT

RONALD D. ROSS

Long delays in getting a Defense Power Administration organized at the Department of Interior may prove costly to the electric utilities. Until DPA is staffed and operating, they can have no real voice in the making of control policies. And these policies already include regulation of supplies of a host of materials vital to utility operations and the industry's expansion program.

The plain fact is that the electric utilities are scrimmaging for vital metals with a lineup of substitutes. The "first team," the DPA staff which must establish the agency's policies and make them work, has not even been named as this is written. This is despite the fact that the very serious "game" of organizing the nation's economy for a war effort is well under way.

Functioning of DPA Delayed

Delay in getting the industry's "claimant agency" functioning shows up clearly in the briefest catalog of the past few months' developments:

June 25—South Korea invaded.

Sept 8—President signed Defense Production Act.

Sept 9—Electric power controls delegated to Interior by Presidential order.

Dec 4—Defense Power Administration established by Secretary Chapman.

The law establishing broad control authority had been written and the new controls power distributed among government agencies 76 days after the 38th parallel was crossed. It was 86 days later that DPA was set up. And then it was only a shell, pending the selection of an administrator.

It could be argued that some other industries are in the same position as the electric utilities—three other defense adminstrations were established at Interior at the same time as DPA. But it should be remembered, too, that Commerce's National Production Authority had issued orders covering such materials as aluminum, copper, columbium, steel, zinc, and cobalt before DPA was formally created.

Who Is to Blame?

Blame for the delay in establishing and staffing DPA is not easily placed. Secretary Chapman, of course, is responsible for setting up the agency and naming an administrator. However, he cannot be blamed for moving cautiously. Industry officials who have been proposed for the top DPA job have not declined without good reasons. And, in any event, this is no time for blame or recrimination.

The electric utility industry needs a strong, effective DPA. This will require not only the prompt action of the Secretary of the Interior, but the full cooperation of all of the nation's electric producers as well. Anything less could threaten the utilities' expansion program, and, as a result, jeopardize the defense effort.

There is a brighter side to the picture. Temporary and consulting officials from private industry and federal and public power agencies have performed important service. They have informally aided utilities faced with supply problems, inaugurated surveys, and represented the industry ably if not officially in control parleys.

TECHNICAL NOTES

ARCHER E. KNOWLTON

(From papers presented at ASME Annual Meeting, Nov. 26 to Dec. 1, 1950)

Fireside deposit troubles, in stokers at Delray, were greatly reduced by increasing the humidity of the combustion air to at least 16 lb of water per 1,000 lb of dry air. (50A-86)

Cycle factors of 1,800 psi 1,000 F/1,000 F reheat have been chosen for a new Consolidated Edison plant of six 160 cross-compound units after critical analysis of 32 alternatives. (50A-87)

Gas turbine operation for 13 months at Belle Isle has had 79.5% availability (hours forced out, 34), steam station heat-rate improvement of 2.25%, unit fuel cost of 1.17 mills per kwhr and an indicated maintenance of $1 per kw per year. (50A-78)

Aluminum alloy heat exchanger tubes have given satisfactory life in fresh and salt cooling waters; aluminum tubes are used in tubular air preheaters. (50A-123)

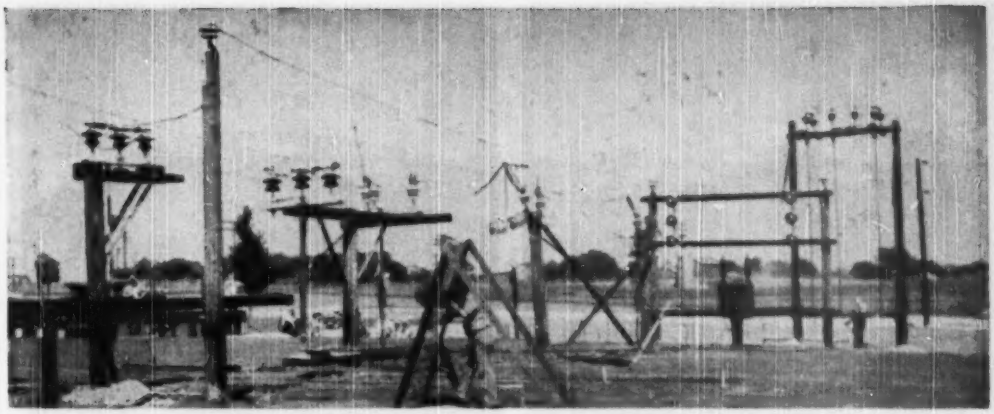
Advance of total steam temperature to 1,100 F and upwards will require superior alloy tubing materials for superheaters to withstand oxidation, have long life at metal temperatures of 1,200-1,400 F, be amenable to tube production, fabricating and welding. (50A-129)

Nickel-chromium-molybdenum steel (WC-4) in a welded valve casting after 6 years of 900 F service for Detroit Edison disclosed no loss of strength, no embrittlement and no graphitization. (50A-67)

Improved refining results in decreased yield of residual fuel oil from a given amount of crude, but total national production of residual fuel has remained about constant because demand for gasoline has resulted in increased refinery output. (50A-131)

Trend in technology is toward expanding the area of interfuel competition . . . by increasing knowledge of converting the various fuels into forms usable. (Boyd, U. S. Bureau of Mines)

Furnace heat absorption efficiency decreases with increase of load and increase of excess air; gas temperature entering superheater is higher when all pulverized coal burners are used. (Willow Island, 50A-82)



SWITCH TESTS were made on six different types of horn-gap switches, as are shown in this view of the test set-up

Establish "Reach" Limits As Measure Of Switch Performance

Data offers design guide in horn gap switch application. Tests include breaking of parallel circuits, interruption of inductive loads and capacitive loads

M. A. ANDERSSON, Engineer
Public Service Company of Northern Illinois, Chicago, Ill.

The desirability of establishing a basis for estimating the load interrupting ability of horn-gap switches has led the Public Service Co of Northern Illinois to explore the problem in a program of tests that involved more than 400 switch openings. In addition to recording data on currents interrupted and arc voltages, moving pictures in slow-motion were taken using cameras at right angles so that arc lengths could be calculated.

Two basic concepts of arc behavior were involved in the study. One is that the length of an arc is proportional to the voltage appearing across it. The other is that an unconfined arc will always extinguish itself if clearance will permit its growth to a necessary critical length and if the gap is wide enough to prevent restriking.

To provide a measure of arc performance the term "reach" has been used. It is defined as the distance from a point midway between the arc terminals to the most remote point reached by the arc. Reach in its most critical direction, then, is coincident with minimum phase-to-phase or phase-to-ground clearance.

General conclusions . . . The test data supported four general conclusions:

1. A horn-gap switch will interrupt a current successfully if its dimensions will permit the arc to grow to its critical length. An exception might be with the wind blowing in line with the arcing horns.

2. With conventional horn-gap switches, arc length and "reach" are independent of the type of switch and of the speed of its operation.

3. Two arcs in series will have about the same total length as a single arc produced under the same conditions. However one of the pair of arcs may be much longer than the other.

4. Arcs are longer when interrupting line charging current than when interrupting a corresponding amount of resistive or inductive current.

Specific Conclusions . . . Test conclusions specifically applicable to operation and design are these:

1. For resistive and inductive currents below 100-amp, reach depends on both voltage and current. Maximum reach for practical use in this range is 0.0165 ft per amp per kv across the open switch gap.

2. For resistive and inductive currents from 100 to 320 amp, reach is proportional to voltage but independent of current magnitude. Maximum reach for practical use in this range is 1.65 ft per kv across the open switch gap.

3. On 132-kv horn-gap switches having 16-ft horizontal phase separation, about 7 amp of charging cur-

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From paper, "Interrupting Ability of Horn Gap Switches" by L. R. James, F. E. Andrews and M. A. Andersson, presented at AIEE Summer Convention in Pasadena, Cal., June 1950.

FIG 1—CORRESPONDING RIGHT ANGLE VIEWS of an arc from the parallel breaking of 296 amp, at 7.19 kv across the switch, show arc length of 19.1 ft, reach of 7.2 ft

FIG 2—SIMULTANEOUS RIGHT ANGLE VIEWS of exciting current arc when interrupting 12.8 amp, 49.2 kv across the switch, show arc length of 21.9 ft, reach of 4.5 ft

rent (approximately 17 miles of line) can be opened with reasonable safety.

Character of Tests . . . Tests were made at a frequency of 60 cycles. Various types of switches were used in both single and three-phase circuits. In general, oscillograph readings were taken of current and voltage. Arc length and reach were determined by geometrical combination of scale values determined from the corresponding projections of motion picture frames showing maximum length. Special test setups were used in some cases in order to secure as wide a range of test data as possible, but all tests corresponded to normal service conditions. One of these test setups is shown above in which one phase of a 33-kv transmission line was connected

FIG 3—BREAKING 20-amp charging current, 132-kv line. Arc length is 123 ft, reach 29 ft; switch clearance 16 ft

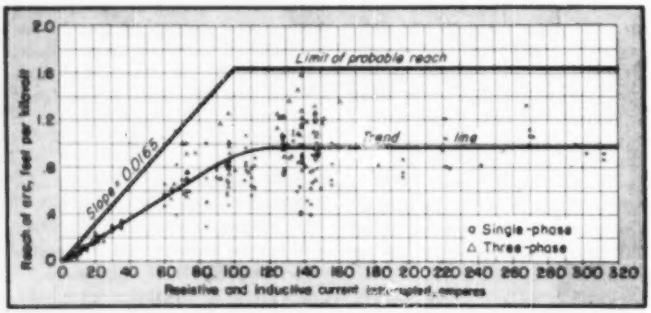


FIG 4—TREND LINE of arc reach, and limit of probable arc reach per kv were established for horn gap switches interrupting varying inductive and resistive loads. Possibility is rare that upper-envelope safe-guide values will be exceeded

so that a wide range of loop current values could be interrupted on any one of six different types of horn-gap switches.

The tests covered three general types of switch use:

1. Breaking parallel by interruption of one side of a 33-kv loop and transferring its load to parallel paths. Currents of 60 to 312 amp were interrupted in loop systems of 10 to 44 ohms. Arc voltages of 1,000 to 7,350 v were obtained. Fig 1 shows corresponding right angle views of a typical single-phase arc obtained in this group of tests.

2. Interruption of inductive load by dropping transformer exciting current at full line voltage. This group of tests covered currents of from 6 to 35 amp at line voltages of from 12 to 49 kv. Fig 2 shows a single-phase arc typical of this group of tests.

3. Interruption of capacitive load by dropping line charging currents on 132-kv transmission lines. Sections of line from 4 to 50 miles in length were opened providing a range of from 2 to 20 amp. A single camera view of arcs obtained by opening 20 amp of charging current is shown in Fig 3.

The three basic variables in arc data were analyzed by using the current interrupted (current at beginning of arcing period), the voltage just after extinction in loop interruption, or line voltage in load dropping tests, and the arc length when the arc was longest, which was invariably during the last cycle of time. By taking advantage of the proportionality of arc voltage and length, these two variables were reduced to a single one of feet per kilovolt.

For the range of current values interrupted, no appreciable difference was found in results due to the type of switch used or the speed of operation.

It was found that a general trend could be established in the data for resistive and inductive currents when arc length was plotted in terms of feet per kilovolt. However, arc length was considered to be too indefinite a dimension for practical use since it is not the arc length but rather the direction of maximum spread, or reach, which is of importance in determining interrupting ability.

Significance of Reach . . . Since reach in its most critical direction is coincident with minimum phase-to-phase, or phase-to-ground clearance it is a direct measure of the interrupting ability of a switch.

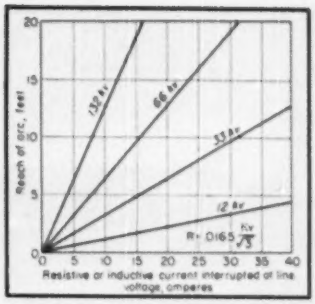


FIG 5—FOR SMALL CURRENTS at various line voltages, arc reach was determined from analysis of the test results

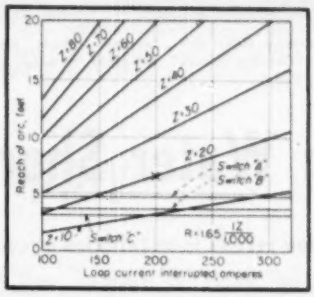


FIG 6—FOR LARGE LOOP CURRENTS in loops of various impedances, arc reach was determined from analysis of test results. Horizontal lines indicate safe reach for various types of switches

With the data analyzed on the basis of this new variable a general trend was established by the "Trend Line" drawn medially through the data as plotted in Fig 4.

It is recognized that the variation between minimum and maximum reaches for any value of current is large, particularly in the range of 60-140 amp. This spread is thought to be due mainly to uncontrollable factors such as variations in atmospheric conditions and magnetic and thermal effects, plus the possibility of errors in correctly identifying corresponding points of maximum reach in the film projections.

However, it is believed that the possibility of exceeding an upper envelope of the reach values is sufficiently rare that such an envelope may be used as a safe guide for switch operation. In fact, to exceed safe values the possibility of such an abnormal reach would have to coincide with the possibility of wind being in exactly the direction of minimum clearance distance. On this basis an upper envelope has been drawn in Fig 4 and is shown as the "Limit of Probable Reach." This limit therefore provides a convenient standard of resistive and inductive arc performance as follows:

Range of Current	Probable Reach in Ft
0 to 100 amp	.0165 per kv per amp
100 to 320 amp	1.65 per kv

Reach for Charging Currents . . . While the data for the line charging currents was too limited to allow an extensive analysis, the values of reach in general were twice the trend of values for reach for corresponding resistive and inductive currents. This is to be expected due to the combination of trapped charge in the isolated capacitive circuit with the line voltage tending to produce double voltage across the switch.

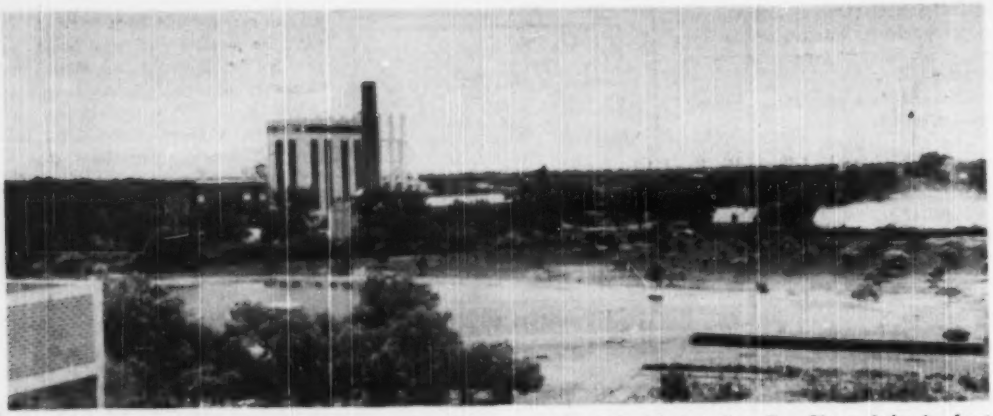
Sufficient charging current tests were made to establish about 7 amp as the maximum safe value to be interrupted at 132 kv on switches with phase spacing of 16 ft.

For application to practical use the limits of probable reach as developed have been plotted for the range of normal current and voltage values. This results in convenient operating and design guides.

Fig 5 shows maximum expected arc reach for currents up to 40 amp. Since these smaller currents are usually associated with the interruption of transformer exciting currents, guide lines have been developed for nominal line voltages in general use on our system. Reach to be expected can be read directly from the chart.

Fig 6 shows maximum expected arc reach for currents from 100 to 300 amp, normally associated with the loop current interruption. In this range guide lines have been developed for various system impedances. Use as an operating guide involves calculation of the loop circuit impedance by usual methods of network reduction and then reading the expected reach directly from the chart. In practice it will often be found possible to actually measure loop impedance in advance by opening an oil switch elsewhere in the line and measuring the open switch voltage. This voltage across the switch divided by the cur-

(Continued on page 150)

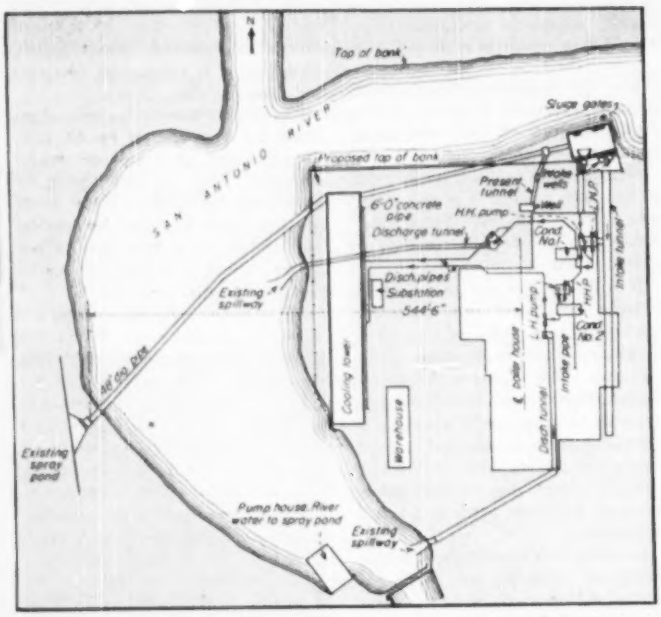


MISSION ROAD PLANT spray pond at extreme right discharges into collecting basin on river bank. Cooling towers (center) adjoin plant and walls. River circles in front of plant between cooling tower and spray pond, at right

Cooling Water Shortage Prompts

Drought-curtailed river flow results in installation of cooling tower, adaptation of spray-pond and back-up resort to artesian well for condensing supply

J. H. HOCHULI, Project Engineer
Gibbs & Hill, Inc, New York, N. Y.



CIRCULATING WATER discharged by tunnel to two points above dam. Pumps opposite deliver water to spray pond. Pipe takes cooling water from spray pond across river to cooling tower basin. Cooling water and make-up amplified by artesian well discharge into 6-ft diam concrete pipe feeding the cofferdam

Adequate cooling water is a prime requisite for plant additions if they are to be as firm as the initial installation in the plant. Recognition of this prompted the City of San Antonio to offset the threat of drought in the area by providing four sources of cooling water for the condensers: (1) River water, (2) spray pond, (3) cooling tower, (4) artesian well.

Addition to the Mission Road Plant of a duplicate* 25,000-kw unit and a 325,000 lb per hr boiler prompted analyses of the adequacy of condensing water for full capacity operation. A cooling tower was immediately indicated and then the intensified drought in Texas necessitated additional supply of cooling water.

Several economic studies were made using river water, spray pond water from an existing pond on the west bank of the river, a 19,000 gpm

* See "New Correlated with Old in Mission Road Plant" by the author in Electrical World, September 15, 1945, page 88.

COOLING TOWER BASIN is 38¾x278 ft and can handle 50,000-gpm cooling tower reduction from 103 F to 90 F with a wet bulb of 76.5 F. Main header is so arranged that water from either condenser can be pumped to either or both towers

Four-Source Supply

artesian well located at the northwest corner of the power plant, and a combination of one or two cooling towers. These studies showed that with the addition of a second tower the plant could carry full load under all conditions. It also indicated that by the addition of sprays handling 16,000 gpm the well could be dispensed with should it be shut down for any reason. It was therefore decided to complete the project as indicated.

The spray pond was rearranged to discharge the water into a collecting basin on the west river bank. This basin was connected by a 48-in. concrete pipe laid under the river to a catch basin collecting all the water falling over the two cooling towers. This catch basin was connected by a 6-ft-diam concrete pipe to a new cofferdam built outside the intake tunnel feeding all of the turbogenerator units. The cofferdam was fitted with slide gates which could be opened or closed depending on whether the river or cooling tower water was used in the condensers.

A high head pump was added to the circulating water system of Unit No. 1 and high and low head pumps purchased for Unit No. 2. The high head pumps were used for delivery of water to the cooling towers and the low head pumps for discharge to the river. Electrically controlled butterfly valves were installed at the discharge of both pumps and pipe lines leading to the cooling towers and river. These valves were interlocked so that the proper ones were open for use with either system.

Each cooling tower of the induced draft type consists of five cells. Each tower is capable of cooling 25,000 gpm from 103 F to 90 F with a wet bulb of 76.5 F. The towers are installed in a straight line west of the plant near the river and are so arranged as to discharge into a common basin. Each cell is fed independently with water and can be segregated without affecting the other cells. The main header is so arranged that water from either condenser can be pumped to either tower or both towers can be used for either condenser. An overboard line is piped directly to the river from the header to completely clear the system if necessary.

The cost of providing the back-up supply increased the unit investment in the plant by $3.22 per kw based on 80,000 kw.

Justification for the supplementary facilities is found in the 1949 summer experience which showed the methods of operation that are shown in Table 2 were necessitated by the dwindling river flow.

TABLE I—Costs of Firming Capacity For Summer Operation

Cost of Changes Involving Circulating Water System	Cost, Dollars	Cost Per kw, Dollars
Circulating water system with cooling tower for Unit 2	$183,000	$7.35
Changes for use of river for Unit 2	18,750	0.75
Changes to system and addition of cooling tower for Unit 1	179,215	7.17
Changes to system to firm up old plant (30,000 kw)	60,000	2.00
Total Costs*		
Addition of Unit 2, (25,000 kw) without changes to Unit No. 1 and old plant	$3,047,678	$121.90
Firming of plant for 80,000 kw and addition of Unit No. 2, 25,000 kw	3,286,893	.....

* Total costs include all engineering and construction overhead.

TABLE II—Operation of Spray Pond and Cooling Tower, June–Sept., 1949

Period, Starting Week	Cooling Tower, Hours in use		Spray Ponds, Hours in use		
	No. 1	No. 2	No. 2	No. 3	No. 4
June 1	168	168	71	129	149
June 8	168	168	54	75	168
June 15	168	168	61	117	163
June 22	168	168	76	136	150
June 29	168	168	58	168	168
July 6	168	164	114	168	168
July 13	168	72	124	160	168
July 20	168	168	97	135	168
July 27	168	168	118	139	168
Aug. 3	168	168	86	137	168
Aug. 10	168	168	117	151	168
Aug. 17	168	168	87	129	146
Aug. 24	161	168	93	100	101
Sept. 1	168	168	48	77	80
Sept. 8	168	168	73	92	92
Sept. 15	123	125	63	127	168
Sept. 22	108	162	19	79	113

Note: Operation of cooling water system is dependent on inlet water temperature of condensers. Operation of spray ponds and cooling towers was supplemented by operation of water wells when required by temperature conditions.

Two Numerical Indexes Evaluate Masses of Meter Test Data

Numerical average and standard deviation afford basis for comparing meters as to type, prior test, and service results as well as testing differences in shop, field, and division

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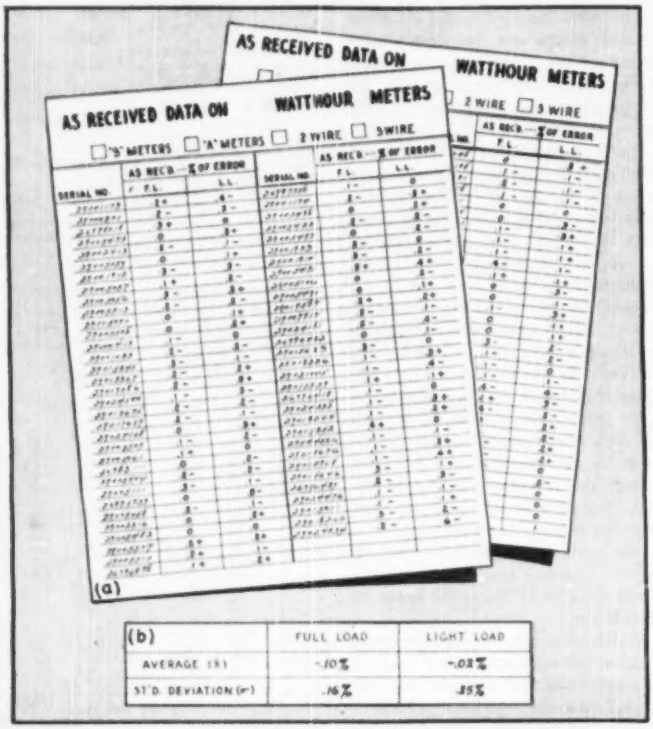
General Electric Co., Lynn, Mass.

By a new method of evaluation, overall accuracy of any group of watthour meters can now be expressed by two numbers—the average and the "standard deviation." Use of the new method has proved effective at every stage of metering practice. Groups of meters may be: (1) As built by a manufacturer, (2) as received by the utility, (3) as installed by the utility, or (4) "as found" on periodic test after being in service. It reduces masses of data to simple concise form, permitting accurate and rapid comparisons between groups and correct conclusions to be reached.



(b)	FULL LOAD	LIGHT LOAD
AVERAGE ($\bar{X}$)	-.10%	-.02%
ST'D. DEVIATION (σ)	.16%	.15%

FIG 1—TYPICAL TEST DATA for 130 meters at light and full load, resulting in however, be erroneous when comparing groups where the number of units differ

Use of this method as an everyday means of summarizing and transmitting meter-accuracy information is very recent, but the theory of probability and statistics underlying it is well-documented and detailed in standard mathematical books.

The Method . . . Test of a large number of meters results in the accumulation of so many numbers that the mind has considerable difficulty in determining their significance. Typical calibration data on a group of 130 watthour meters are illustrated in Fig 1a. The new method permits complete and accurate description of this mass of data by two index numbers for each load point as shown by Fig 1b. The first, bar X ($\bar{X}$), measures the average of the data, while the second, the standard deviation, sigma (σ), describes the dispersion of the data relative to the average.

Distribution curves of the data of Fig 1a are shown in Fig 2. Such curves are a familiar means of reducing a mass of numerical data to a form which permits quick visual appraisal. An experienced person can often reach very logical and valuable conclusions from such visual appraisals. However, the hazards of improper interpretation are great. Comparison of distribution curves is particularly difficult when the number of units in the groups differ. A conclusion drawn by visual appraisal is open to the challenge that the observer may have been influenced by prior prejudice or by excessive consideration to minor defects in the data. Anyone who has had to defend conclusions drawn from visual appraisal will welcome a better method of evaluating the properties of a distribution curve.

Probability . . . Application of the law of probability to this problem permits calculation of the two numbers which completely describe the normal distribution curve. The first number is the arithmetic mean, often called the

average and identified by $\bar{X}$. The second figure is the standard deviation, generally identified by the Greek small letter sigma, σ, which provides a measure of the dispersion of the data about the average. Manner by which the standard deviation gives a very complete description of the dispersion of normal data is reflected in Fig 3. Roughly 68% of the data will fall within the limits of ± one σ about the average, 95% within ± two σ, and 99.7% within ± three. Memorizing this basic characteristic of sigma permits immediate mental reconstruction of the distribution curve and its appraisal as soon as the values of $\bar{X}$ and σ are specified.

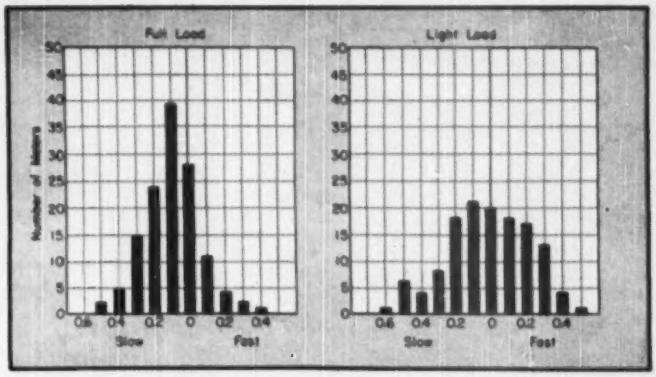


FIG 2—DISTRIBUTED FORM of data in Fig 1a gives visual indication that may, however, be erroneous when comparing groups where the number of units differ

Calculation of $\bar{X}$ and σ . . . The basic mathematical formula for calculating the standard deviation may be readily applied to practical problems by use of a sample chart form. In this way time is saved, the hazard of arithmetical error is reduced, and the work can be performed by anyone with basic knowledge of arithmetic.

A sample chart form (Fig 4) has been developed specifically for analyzing meter-calibration data step by step, and finding the average ($\bar{X}$) and the standard deviation (σ). Since optimum calibration is almost universally 100%, it is convenient to consider only the calibration error as a deviation from 100%. Thus, a calibration of 99.6% is considered to have an error of −0.4%. Not only does this reduce the number of digits to be recorded, but the problem of squaring and multiplying is reduced to a minimum.

Preparation . . . To be effective, data must be prepared and presented in as clear and concise a manner as possible. The distribution curve, when combined with it $\bar{X}$ and σ, is usually found to be very easily understood and effective. A few comments on the details of taking, summarizing, calculating, and presenting the data in this manner may prove very helpful to those performing the operations for the first time.

In the distribution curve of Fig 2, the data are arranged in columns representing the number of meters in each 0.1% accuracy interval. In most watthour-meter work an interval of 0.1% is found to be most practical, since the usual practice in meter testing is to record the data to the nearest 0.1%. For simplicity, the error for these intervals would normally be designated as 0%, +0.1%, +0.2%, etc.

Tally Sheet . . . To make the recording and summarizing of data easier, a tally sheet may be used with separate block for each five meters having the various tenths percent error. Such a tally form may be used in cases where the very minimum of recording effort is desired and also in summarizing data that are available in tabulated form, such as Fig 1. This tally provides the total number of meters found in each interval and is entered in the first column of the chart of Fig 4. It also provides a reasonable accurate visual portrayal of the distribution curve of the data.

In order to compare distribution curves, it is desirable to plot in a standard manner. By converting the coordinate from number of meters to a percentage of the total number in the group, distribution curves that permit visual appraisal and comparison are achieved. Such curves are particularly useful as a visual aid in presenting and interpreting data by this method.

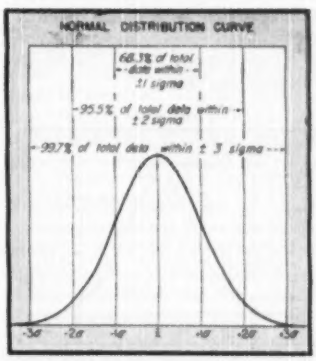


FIG 3—PROBABILITY RESULTS in 68.3% of the total data falling within one sigma of deviation, 95.5% within two, and 99.7% within three

Application . . . Analysis of the results indicated in Fig 5 is interesting in determining:

1. Relationship of the reference watthour used by the manufacturer and the utilities.
2. The effect of shipment on the calibration of the meters.
3. If the test methods of the manufacturer and the utility give comparable results.

Visual appraisal of the distribution curves permits one to offer the opinion that there is little, if any, difference in the full-load calibration results, but that a greater dispersion of light-load calibration was found by the utilities than by the factory. Referring to the $\bar{X}$ and σ data on each curve enables us to reduce these opinions to numbers. The value of the reference watthour as used by the utilities agrees with the manufacturer to within 0.03% at full load and 0.13% at light load. There is very slight effect from shipment on the meters, the average calibration before and after shipment coinciding at full load and agreeing within 0.06% at light load.

There is excellent agreement at full load between the value of σ before and after the shipping test and "as received" by the utilities, showing there

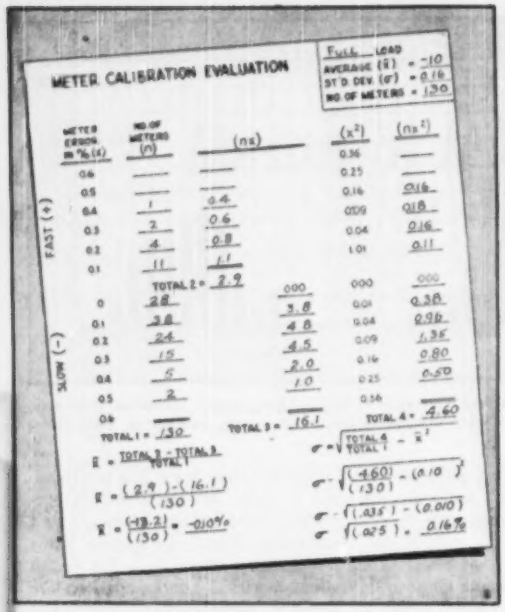


FIG 4—COMPLEX EXPRESSIONS of probability technique are completely circumvented by systematic and simple manipulation of the data. Chart was developed for analyzing calibration data and finding mean and standard deviation

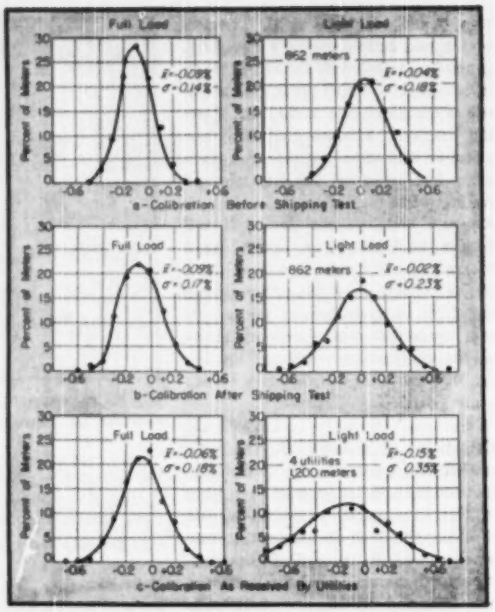


FIG 5—SYSTEMATIC ANALYSIS shows how much modern watthour meter accuracy is affected by shipment; (a) 862 meters before and (b) after round trip across continent, (c) 1,200 meters as received from the factory by four utilities

is little change in the meters and also that the test equipments used have equal precisions. On light load, the shipping test shows a difference after shipping of only 0.05% in σ, while a difference of 0.17% is shown in the "as received" tests by the utilities.

From these data it may be concluded that shipment has a small effect on the light-load calibration. However, the fact that the "as received" tests by the utilities show a greater difference indicates that factors are present which have affected the precision of the light-load tests.

Precision Factors . . . Experience in watthour-meter testing indicates that some of the factors which affect precision are:

1. Short tests, thereby increasing effect of reading errors.

2. Windage effects, due to open windows or fans.

3. Variation in test load from rated light load.

4. Starting and stopping variations of operators or equipment.

One or several of these or other possible factors may be present in a particular test location to a degree that the precision of testing is materially affected. This new method of analyzing calibration data provides a tool for the use of both utilities and manufacturers in studying such problems.

Correlation Good . . . Experience with meter-calibration data has shown a very high degree of conformity with the "normal" law of probability. Fig 6 shows the correlation between the theoretical curve and the actual data as recorded on 3,400 meters taken at random from the outgoing production of a manufacturer during the month of September, 1950.

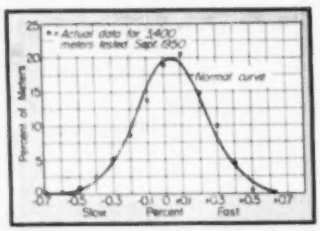
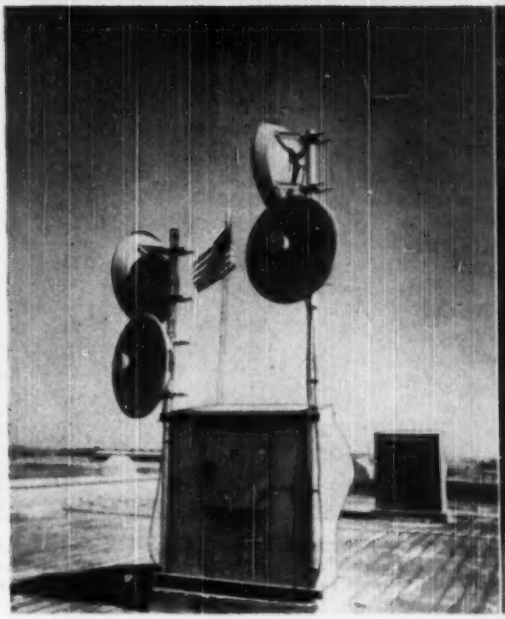


FIG 6—HIGH CORRELATION of dispersion data for 3,400 meters with normal probability justifies use of simplified technique in analyzing meter test data

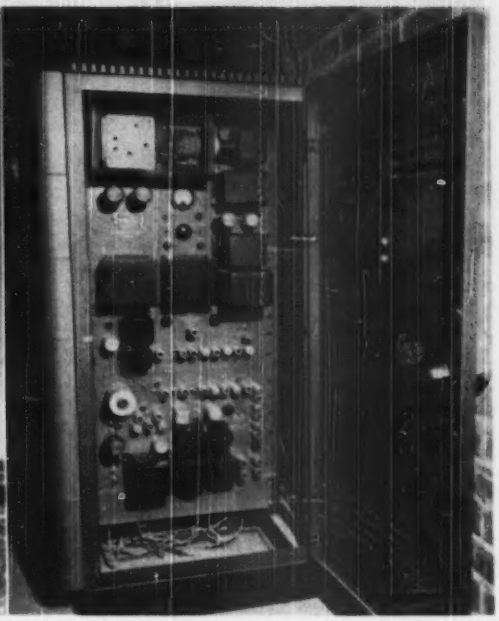
Data which do not conform to the "bell-shaped" curve of the "normal" probability curve should be challenged. Investigation invariably reveals an assignable cause peculiar to these particular data which usually can be corrected or improved. Of equal importance is the fact that investigation of individual data that fall near the edge, but within the normal curve, seldom reveals a specific cause for the variation.

Derivation of the "normal" probability law and the basic formula for calculating sigma are detailed in a number of books on the subject of probability and statistics. Since experience with this type of mathematics is not needed to apply the method, this article has not delved deeply into the theory.

Use of $\bar{X}$ and σ as a precise method of analyzing calibration data already has proved effective at every stage of metering practice. With more widespread knowledge and use of the method, it is expected that the industry will find this new method to be the accepted means of appraising and comparing the performance of watthour meters.



DEPENDABILITY of microwave communication has been established by the two links served by these two pairs of receiving and transmitting antennas of Central Arizona Light & Power. The company has experienced 16 months of successful operation since installation of the first link in July 1949



UNIT CONSTRUCTION facilitates simple maintenance on electronic components. Transmitter, exciter, and receiver units are wired with individual terminal strips and are easily removable. A clear line of sight between sending and receiving ends is important if maximum signal strength is to be received

Microwave Proves Dependable in Action

T. A. PHILLIPS, Chief Engineer
Central Arizona Light & Power Co, Phoenix, Ariz.

Successful operation of a communication, telemetering, and remote control microwave installation since June 1949 has convinced Central Arizona Light & Power of the dependability of modern microwave equipment. Despite ambient temperatures that went as high as 140 F, severe lightning storms, and unusual exposure to sand, dust, and insects, the equipment provided excellent continuity of service.

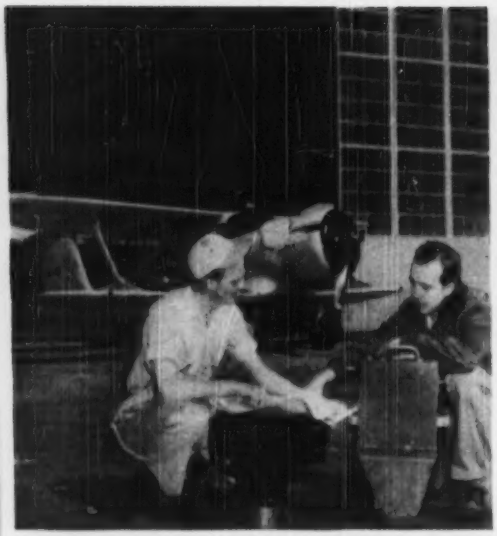
First installation on the system was a link put in service in July 1949, between the company's steam-electric generating plant five miles west of Phoenix, Ariz., and a switching station 16.2 miles west of the plant. This link provides remote control and indication on five 69-kv breakers, telemetering of voltage, current, or power on the two lines which feed the station, and a two-way voice channel. Second installation was a link to another switching station 17.4 miles north of the plant. This link controls two breakers and also provides telemetering and a voice channel between plant and switching station.

Double Duty Transmitter . . . Each switching station has a 3-w transmitter operating at 956.75 mc. A single 3-w, 958.25-mc transmitter at the steam station serves both links. It is switched from one sending antenna to the other by a coaxial type antenna relay. Separate receivers are connected to the receiving antennas at the plant, however, to allow simultaneous reception from both switching stations.

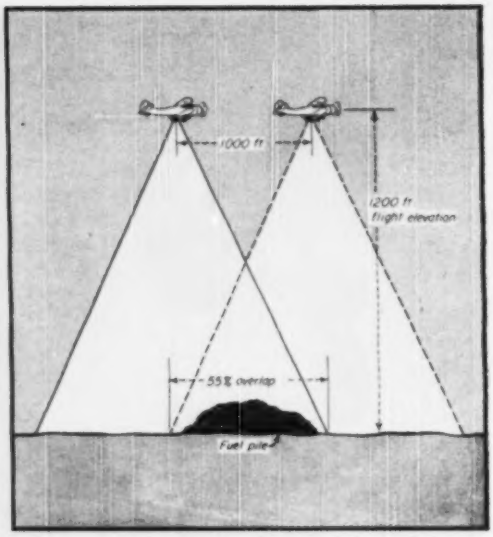
Antenna Arrangement . . . Each switching station has a sending antenna and a receiving antenna mounted one above the other on the same pole approximately 69 ft and 75 ft respectively above ground level. Both sending and receiving antennas are 42-in. parabolic reflector type. All four antennas at the common end of the two links are mounted on one mast on the roof of the steam-electric generating plant. The transmitting antennas at this location are uppermost so the arriving and departing signals will travel in parallel paths instead of crossing.

Opposite Polarization . . . In each link one set of antennas (sending and receiving at opposite ends of the link) has been horizontally polarized, the other vertically polarized. This reduces feedback or interaction be-

(*Continued on page* 150)



1 PILOT-PHOTOGRAPHER TEAM in a single afternoon photographed the company's 10 stockpile sites, all lying in a 30 mile circle. Previous ground surveys took 225 man-days



2 STEREO PHOTOS that overlapped 55% were made at each stockpile site from 1,200 ft. Plane travels about 1,000 ft between pictures, giving large third dimension effect

Fuel Stockpiles Inventoried By Air At Saving of 25%

Using modern three dimension aerial photography Philadelphia utility inventories its 39 coal piles in 10 days with 95 to 97% accuracy at 25% cost saving

BIRON GANSER, Manager
International Auditing Div
Philadelphia Electric Co

EDWARD A. SCHUCH, Chief Engineer
Aero Service Corp
Philadelphia, Pa.

For the first time, this fall Philadelphia Electric Co inventoried the 39 coal piles in its 10 widely-scattered storage sites from the air using aerial photographs and modern stereoscopic mapping techniques instead of rod and level surveys on the ground.

These are the benefits that were obtained:

1. Final fuel inventory figures were obtained in 10 days instead of several weeks.
2. A single inventory date was obtained for all stockpiles.
3. Results accurate within 3 to 5%.
4. Cost of fuel inventory was cut 25%.
5. Survey personnel were freed for other important work.

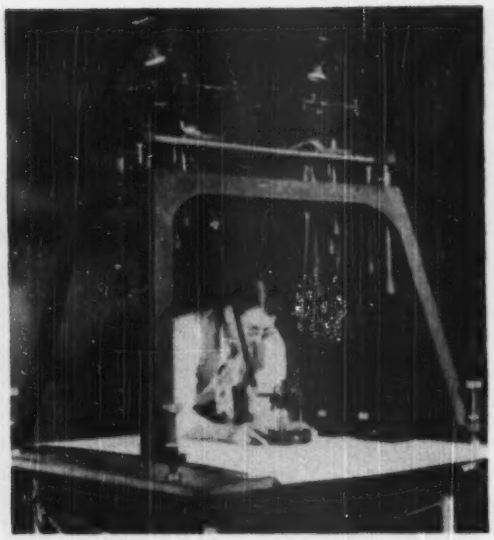
Previous Methods . . . Until this year, the company has used conventional topographical survey methods on the ground to determine the contour and volume of coal piles. Last year this inventory method required 225 man days and interrupted the regular work of the surveyors during the period of the inventory. There were other headaches too. Some of the stockpiles took several days to survey. Additions or withdrawals from these piles changed their volumes and made corrections to a single inventory date difficult if not impossible to accomplish with any degree of accuracy.

Aerial photography and topographic mapping by stereoscopic methods have been used in connection with reservoir studies as well as transmission line projects*. With these applications in mind, it seemed apparent that methods of a similar nature could be put to use for the purpose of inventorying coal stocks.

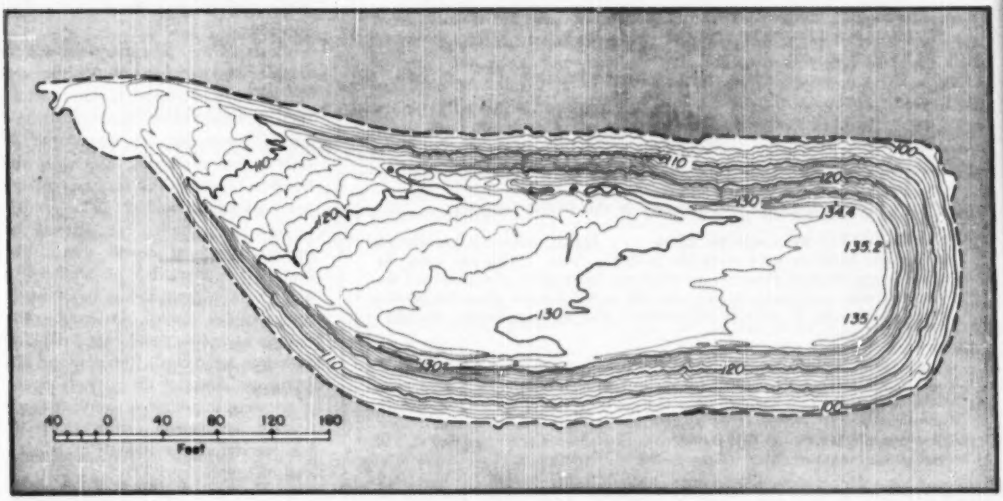
The Photographing Flight . . . Company coal stockpiles are located within a 30-mile circle in Philadelphia and the four adjacent counties. Accordingly, it was possible to "take" the necessary aerial photographs of all 10 storage sites in a single afternoon. When a good mapping day occurred,

* See Electrical World, April 10, 1950 page 96.

3 FIELD SURVEY CREW establish a network of datum points of known elevation and separation for plotting contours—two horizontal, four vertical points at each pile



4 AIR PHOTOS or "stereo pairs" projected through Kelsh plotter are viewed through bi-color glasses by operator who traces contours from three dimensioned image

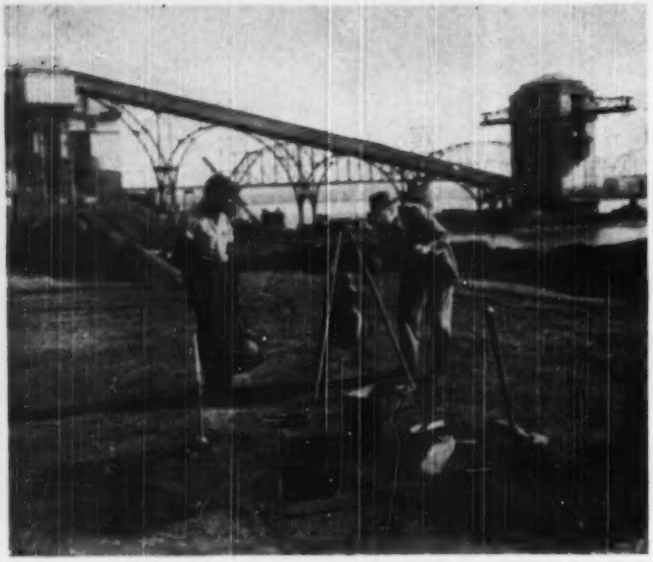


5 CONTOUR MAP for coal stockpile at Petty's Island, contoured at 1-ft intervals with horizontal scale 1 in. = 40 ft. From map, area for each contour "layer" was measured with polar planimeter. Volume of pile is 2,576,889 cu ft

the utility was notified that the photographs would be taken and the approximate time when the plane would be over each stockpile site. Company personnel on watch noted the time, and the mapping plane flew over at an altitude of 1,200 feet, and so fixed exactly the inventory hour. "Stereo" photos were taken at each location, the two pictures overlapping 55% or more.

The aerial mapping company's field survey crews next established the elevation and the distance between four fixed datum points, for each location photographed, to serve as ground controls. Permanent points were selected which would serve as a ground control to be used for subsequent surveys.

Contour Mapping . . . Using these ground datum points as the basis for height and distance measurements, the aerial photographs were studied through stereo-plotting machines. These precise instruments made use of a stereoscopic principle to obtain a



TO DETERMINE DENSITY for converting pile volume to tonnage, samples from each pile are weighed. Myles Higgins weighs a sample from Richmond Station

three-dimensional image of the coal pile from which topographic maps of each coal pile can be constructed—in this case—to a scale of 1 in. equals 40 ft with a 1-ft contour interval. Spot elevations were read to within 0.2 ft on breaks and flat areas.

Using the 1-ft contour lines of the various pile levels the area of the "layer" represented by each contour was measured with a polar planimeter. Volume of each pile was computed from the data thus obtained. Aero Service Corp engineers point out that any error in computation of a particular segment or "layer" of the stockpile was self-corrected as the computations went from peak to base. Maximum error was 3 to 5% or less for an entire pile.

With the volume figures at hand, Philadelphia Electric Co established the tonnage for each stockpile. To do this several coal samples were taken at each stockpile to determine the average weight of a single cubic foot of coal, thus enabling the volume of each stockpile to be readily translated into different grades and weights. Smaller piles of coke and anthracite coal used in gas manufacturing were included in the survey.

The company received the contour manuscripts, a set of aerial photos, and the results of the computations for each stockpile within 10 days after the air photos were taken and the ground controls established. Since these controls are now fixed, next year's inventory will show an even larger savings over the ground survey method.

Costs of the air survey depend on the size and number of stockpiles and the location of airport facilities. Probably a considerable economy would prevail even for air inventories of only a few stockpiles. Certainly the benefits of speed and accuracy of the aerial method would prevail.

Thus, air mapping can be used for reconnaissance of a large area at low cost, for topographic or planimetric mapping at a great saving in time and considerable saving in cost over ground surveys, and for detailed close-ups for records, reports, and advertising. Another air survey benefit of growing importance to utility engineering departments is the release of field personnel for today's increasing load of urgent work.

Other Applications . . . Even more applications of the aerial inventory method will be made. In Canada, a survey of a large "stockpile" of logs by aerial methods is being completed. This method is also practical for tallying ore stockpiles or inventorying spoil banks when reworking is contemplated. Mapping at a scale of 100 ft to the inch, with 2-ft contour interval, has already proved a valuable time-saver in the construction of large industrial plants.

Other Uses for Air Mapping in the Utility Industry

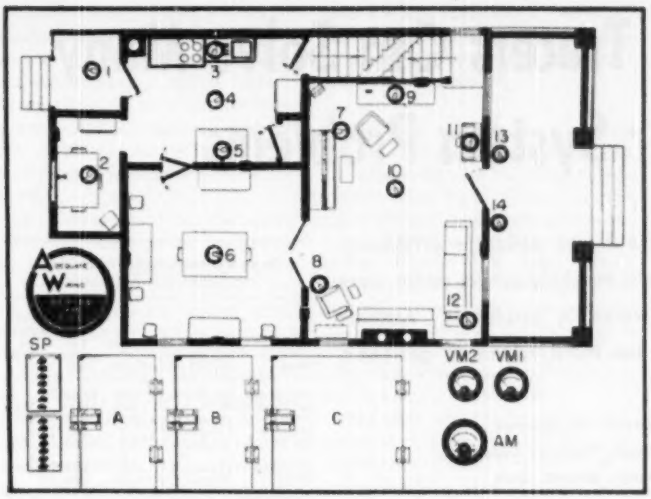
1. Profiling For Transmission Lines . . . Aerial mappers photograph strip about 12,000 ft wide along the probable route. With this strip the utility locates the line. From the aerial photos the mappers plot profile of the line, delivering a planning-profile map 200 to 400 ft wide along the profile. Map shows heights of poles, all obstructions, and, in steep country, the adjacent side slopes.

2. Reservoir Studies For Hydroelectric Power Developments . . . Aerial topographic maps are compiled for design and construction of large reservoirs. Reservoir site is mapped from the air at a contour interval of 5 or 10 ft, and map used for property acquisition, capacity estimates and design. After the dam location is established, construction area is air mapped at 1 ft contour interval, scale 40 ft to the inch for detail design.

3. Planimetric Maps For Inventory Purposes . . . Compiled at a scale of 100 ft to the inch, planimetric maps are used in inventories of the company's physical assets. They provide data needed for rate change studies, tax and administrative purposes.

4. Plant Construction Maps . . . Air mapping can save time in the construction of large plants. Used during World War II and after for construction over large areas (powder plants, Oak Ridge, others) mapping is usually done at a scale of 100 ft to the inch, contour interval 2 ft.

5. Records and Public Relations Purposes . . . Detailed progress photos of new plant construction made from the air, are used by utilities for record and report purposes. They are useful insurance records, illustrations for briefs for utility commissions, annual reports to stockholders, and institutional advertising.



DESIGNATIONS

Back Porch
(1)—60-w ceiling fixture

Breakfast Nook
(2)—200-w ceiling fixture

Kitchen
(3)—150-w wall lamp
(4)—200-w ceiling fixture
(5)—150-w wall lamp

Dining Room
(6)—200-w ceiling fixture

Living Room
(7)—150-w table lamp
(8)—300-w floor lamp
(9)—150-w table lamp
(10)—300-w ceiling fixture
(11)—100-w table lamp
(12)—300-w floor lamp

Front Porch
(13), (14)—40-w brackets

Convenience outlets—1 in breakfast nook, 2 in kitchen, 3 in dining room, 5 in living room. Lamps 3, 5, 7, 8, 9, 11 and 12 connected at convenience outlets.

How We Dramatized Adequate Wiring

Customers can see effect when equipment is switched from adequate to inadequate wiring. Foot-candle meter reading is projected for customers to see, emphasizing what has already been shown on the board

R. W. WILSON, Manager Commercial Sales
Kentucky Utilities Co, Lexington, Ky.

How can customers be made to appreciate the difference between adequate wiring and poor wiring? As part of the answer to that question Kentucky Utilities Co developed a wiring demonstration panel.

Idea for the board was taken from an actual study of a home served by two circuits of No. 14 wire, one to the second floor and one to the first floor and basement. On the board is a scale plan of the first floor of the home with receptacles and convenience outlets for lamps and appliances representing the fixtures and outlets in the home. A 500-w heater coil on the back of the panel represents the load in the basement.

The panel simulates only the one circuit of the first floor and basement. To include the resistance in the actual wiring of the home in the short length of the panel wiring, a resistance coil of 0.194425 ohms is provided in the panel circuit.

At the lower left of the board (SP) are 14 pin switches controlling the 14 lighting outlets. The doors, A, B, and C, provide access, respectively, to a 30-amp service entrance switch, a set of changeover switches, and a 60-amp entrance switch. The board is wired so that its connected load of 3,840 w can be included in one circuit or broken up into 4 circuits. This is the function of the change-over switches. The ammeter measures the current input to the board and the two voltmeters the input and circuit-end potentials.

The board is set up for demonstration by putting lamps of the designated sizes in all receptacles except No. 11. These lamps are silver-bowl or capped to reduce glare in the eyes of the audience. To outlet 11 a table lamp of the proper size is connected. A 1,000-w toaster is at hand for plugging into the breakfast room outlet. Reading of a foot-candle meter under the table lamp is projected on a convenient wall or other surface.

Efforts are made to simplify electrical terms. In demonstrations, the water analogy is used.

An explanation is made as to what lighting should be. Then the board, set up for one-circuit operation, and the foot-candle meter is used to demonstrate what happens in the home during an average day's activities.

Switches are then flipped to simulate adequate wiring with four circuits and conditions are contrasted with those of inadequate wiring.

The entire story is dramatized. The benefits are exemplified by comparing a $5 chair with a $100 chair, pointing out the added comfort, convenience, service and safety of the better one. Customers are given the ABC of adequate wiring. A—is a large enough main switch to carry the load. B—enough branch circuits of sufficient size wire. C—enough convenience outlets, conveniently placed, and enough switches for control to make for convenience of use and operation.

Radioactive Tracers Can Solve Many Power System Problems

Tracers do such jobs as measure flyash collector efficiency, determine where flyash falls, locate manhole covers under snow and determine penetration of water in insulators. Authors tell what tracers to use, how to use them, where to get them

HENRY S. WALKER, Director of Research
ANDREW GEMANT, Staff Physicist, Research Department
The Detroit Edison Company, Detroit, Mich.

Radioactive tracers can be used to advantage in numerous perplexing technical problems confronting electric utilities today. Two particular investigations, involving studies on insulating oils and leak detection in buried underground pipes, are under way in the research department of The Detroit Edison Company.

Radioactive tracers are compounds that contains a radioactive atom which does not affect their chemical properties, but can be used to detect their presence. Because of the great sensitivity of the methods for detecting them, tracers are finding an increasing use in various branches of industry. Besides the two active projects in The Detroit Edison Company, three applications are being studied elsewhere.

Two main groups of applications are considered here: (1) laboratory and (2) field. Those carried out in the laboratory are subject only to standard precautions common to any radioactive work. In plant or field studies the radioactive material might spread into the atmosphere or the ground. Special consideration is then required in order not to transgress tolerance levels, and to make sure that the contaminant will, in a relatively short time, be diluted or dispersed.

I. Laboratory Tests . . . Five practical laboratory uses for radioactive tracers follow: **(a)** Water penetration into various electrical insulators, waterproofing materials, cement and the like can be determined by using, for instance, water labelled* with tritium (H_3) which is now commercially available (1). Tritiated water is also obtainable. Special Geiger-Mueller tubes must be used to detect tritium since its beta radiation is only 11 kv, Fig 1.

(b) The mechanism of electrical conductivity in transformer and cable oils, for example, can be studied by using a tracer-labelled oil-soluble organic acid of a type present in deteriorated oils of relatively high conductivity. Carbon-14 isotope is used successfully for labelling. Adsorption of the acid, sludge formation, and cataphoresis in insulating oils can also be studied in this manner. Such a study is under way in this company (2), Fig 2, at this time.

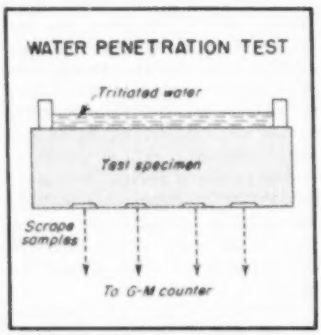


FIG 1—WATER PENETRATION in insulators or insulating materials can be studied by using labeled water

These Are the Isotopes Most Useful As Tracers in Utility Studies

Name	Half-life	Radiation-Mev Beta	Gamma	Price per millicurie	Application (Text, Sect & Par)
Calcium-45	180 days	0.25	none	$2.80	IIc
Carbon-14	5,000 years	0.15	none	36.00	Ib, IIb, e
Chromium-51	26 days	none	0.32	0.58	Ic, e
Cobalt-60	5.3 years	0.31	1.3	1.65	Ic, d
Iron-59	46 days	0.46	1.3	33.00	Ic, d, e, IIe
Sodium-24	15 hours	1.4	2.8	0.80	IIe, b, c
Tritium	12 years	0.011	none	0.20	Ia

(c) To study corrosion a small amount of labelled metals, iron, cobalt, chromium, is added during manufacture to the metal to be studied. The presence of these labelled metals, even in traces, can be detected in the solution in contact with the metal (3). An accelerated corrosion test can be carried out in this manner.

(d) The investigation of fusion welded joints often involves microphotography or autoradiography. In a metal containing a tracer element the location of this latter can be ascertained by photographic imprints of samples. Such a technique has found extensive use in metallography (4), and could be used to advantage in many specific problems, such as the graphitization of steel in welded joints. (5)

(e) In studies of the operation of circuit breakers the tracer technique could be used. The transfer of minute amounts of material from one component of the breaker to another can be determined quantitatively by means of tracer elements. Similar studies in the field of friction (6) have been carried out successfully, Fig 3, and might also be applied to circuit breakers.

II. Plant and Field Tests . . . Among the promising applications for tracers in utility plant and field studies are those involving: **(a)** Slagging of boiler tubes causes considerable trouble in steam plant operation. The mechanism of deposit formation has been partly clarified in recent years (7), and exten-

* A substance in which a radioactive atom is incorporated is said to be labelled.

sive work on this problem is being carried out at present and will be published by this company. The origin of certain elements (iron, silicon, sodium, and others) found in the deposit could be ascertained by tagging atoms at their suspected source and subsequently trying to identify them in the deposit.

(b) Leaks in closed pipes or vessels may be located by introducing into the pipe a radioactive gas and attempting to detect its presence outside. The place of highest concentration would indicate the location of the leak. Such an investigation is being carried on by the Detroit Edison company, Fig 4, and its results will soon be published (.). The gas being used is carbon monoxide, labelled with carbon-14, and one field of possible application is pipe-type, underground, gas-pressure, high-voltage cables. Other possible applications are the detection of leaks in steam pipes, hydrogen cooled generators, and steam condensers. In the latter, the tracer would have to be added to the circulating water and detected in the condensate. In tests of this type, contamination of the ground or public water cannot be completely avoided. The amount of tracer used must, therefore, be small, or else tracers of short half-life like sodium-24 with a half-life of 14.8 hr must be used.

(c) Tracers could be added to fly ash either for the purpose of evaluating the efficiency of precipitators, or for locating the places in the city at which the ash not collected preferentially settles. Rather short-lived isotopes would have to be used for such a study.

(d) The location of underground pipes or man-hole covers blanketed, for example, by snow could be affected by minute amounts (microcuries) of radium or the like embedded safely in the metal and which could be detected by counter tubes on the ground surface, just like in any other surveying operation. Fig 5.

(e) Migration of insulating oil in cables and potheads could be studied by adding suitable radioactive components to the oil. Intensity of radiation must be kept low in order that no noticeable deterioration of the oil take place. There appears to be no danger that the ironizing voltage of the equipment is lowered by the presence of a tracer.

Hints for Experimenters . . . In order that these or similar, applications can be carried out by others, a few practical details are offered.

Procurement of Tracers . . . Tracer materials can be obtained chiefly from the Isotopes Div, Atomic Energy Commission, Oak Ridge, Tennessee, but some labelled compounds are manufactured by a few private companies, largest among them being Tracer Laboratory, Boston. Their use is restricted. From whatever source they are to be ordered, an application must first be filed with and approved by the AEC; forms for which are obtainable on request.

The price of the more common elements is moderate. As shown in the accompanying table, it ranges from $1 per millicurie of iodine-131 to $36 per millicurie of carbon-14. Tagged organic compounds are relatively expensive, the price ranging from $200 to $600 per millicurie carbon-14. Even these prices are lower than the cost of making them in one's own laboratory and the cost of ordering them from an outside source can be justified.

Handling Tracers . . . The handling of tracers is not dangerous if certain precautions are observed. These are pamphlets obtainable (.) that give all the necessary instructions. A novice should start out with ordering not more than a few millicuries, and arrange his experiment so that a single test should involve possibly a fraction of a millicurie. Later, as he gains experience, the amount may be increased. "Soft" radiation tracers, like carbon-14 (C^{14}) need much less precaution than "hard" ones like radium or phosphorus 32. Radiation of carbon-14 is completely eliminated by any thin sheet of solid material or 10 in. of air space. For "hard" radiators, distance is the best protection. If one milligram of radium-capsule is handled one should not, in general, get closer than 10 in. While this distance does not eliminate radiation, it reduces it to a safe, or tolerable, level. For all operations a ventilated hood is necessary if 100 microcuries or more are handled. For operations involving less than 10 microcuries this is not necessary.

What Tracers to Use . . . The accompanying table lists a few of the tracers including their half-life, energy of beta and gamma activity, price and possible application, identified by the number in the listing in the table. Radium is suggested for locating manholes. Radon gas, a product of radium, might well be used in some of the leak loca-

FIG 2—ELECTRICAL CONDUCTIVITY of transformer and cable oils can and is being studied by using tracer-labelled, oil-soluble organic acid

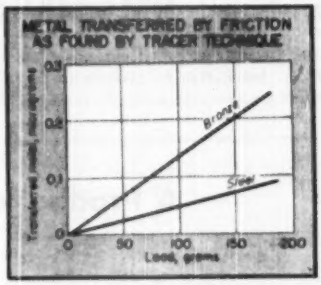


FIG 3—TRANSFERRED METAL, checked by tracer elements can be used to indicate circuit breaker performance

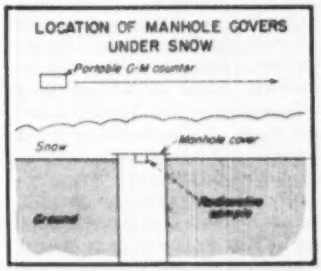


FIG 4—SNOW-COVERED MANHOLES can be located easily if radioactive sample is imbedded in manhole cover

tion problems that are encountered.

Introduction Into Test-Piece . . . In many instances it is possible to introduce the tracer into the test object in the form of the compound as received. Tritium can be purchased in the form of water (replacing ordinary hydrogen in H_2O) for instance; sodium as the carbonate salt in which form it is soluble in water; iron is obtained as the metal. In certain instances the tracer material must be converted chemically into another compound. This is the case if CO gas is required.

Generally, if a gas is used, as for leak detection, the tracer is first converted into the gas and added to the carrier gas, nitrogen, for instance. The concentration should be as low as possible; the lowest limit is set by the sensitivity of the detecting apparatus. If the test object is liquid (water, oil) the compound must be soluble and is then dissolved in the proper low concentration. Metals are labelled by melting and mixing a small portion of the tracer. Irradiation by neutron sources which are now commercially available, can also provide a surface activity. Solid materials, like coal in the fly ash problem, can be sprinkled with an aqueous solution of the tracer.

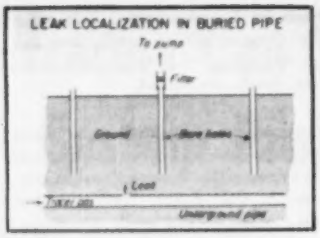


FIG 5—LEAKS IN PIPES or vessels can be located by introducing into the pipe a radioactive gas and detecting its presence outside of the pipe

Measuring Equipment . . . Any of the commercially available laboratory recording counters, like the Victoreen Counter, in conjunction with a Geiger-Mueller tube is suitable for the tests suggested. If soft radiators, carbon-14, are used, a thin-window tube is necessary or a so-called flow counter, like that of the Nuclear Instrument and Chemical Corp, permitting introduction of a sample into the tube is necessary. Other operations like leak detection problems require a portable counter, like that of Nucleonic Corp. The portable counter must be equipped with a meter. For accurate measurement they are not suitable and for such cases a laboratory type instrument is essential.

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A Product of Enterprise and Determination

A Featured Book Review

***Electrical Transmission and Distribution Reference Book*—Fourth Edition. By Central Station Engineers of Westinghouse Electric Corp. Published by Westinghouse Electric Corp. 824 pages, illustrated, $6.00.**

Certainly underlying and possibly explaining the high quality of the engineering information to be found between the covers of this and three earlier editions of the "T and D Reference Book" is the human story of enterprise and determination that surrounded its beginnings.

Very nearly 30 years ago, in 1922, William Nesbit, a central station engineer at East Pittsburgh, was ordered by his doctor to take a complete and protracted rest in the mountains. For a man of less spirit such orders might have spelled complete lassitude. But to Nesbit's active mind physical rest was a spur to mental gymnastics. He was soon hard at it working up design tables for transmission circuits. These became a series of articles in the "Electric Journal" and later a book "Electrical Characteristics of Transmission Circuits." The simple practical nature of this work with its quick estimating charts soon became a classic that went through repeated editions until it became obsolete with advance in the art in 1935.

But Nesbit's enterprise and determination had fired others and in 1942, 14 men in the Westinghouse central station engineering group pooled their efforts to produce a book on transmission lines; one of broader scope that would meet the new conditions but retain the entirely practical viewpoint of its predecessor.

Thus the first edition of Electrical Transmission and Distribution Reference Book was born.

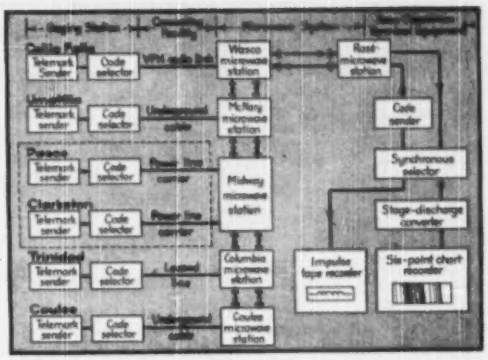
The fourth edition is now being offered; completely rewritten by the same group and following Nesbit's pattern of practicality. The new volume contains essentially the material of previous editions but the end product is much easier to read. Thanks to better, clearer illustrations, and a text that is not only lucid but easier to follow because it is better organized. There are three new chapters—Excitation Systems, Application of Capacitors to Power Systems, and Power Line Carrier Application.

The new chapter on excitation systems embraces a review of common excitation systems, discusses design and characteristics of component parts and the methods of combining them into an optimum system. Included are substantial sections on two relatively new exciter types; the Rotatrol rotating amplifier and the ignitron or electronic exciter.

Both shunt and series capacitor applications and theory are covered in the chapter on capacitors. Of particular timeliness is the portion on fusing and automatic switching of shunt capacitors.

In the new chapter on power line carrier a review of major applications is followed by a fundamental discussion of transmission of high frequency energy over power systems. Also included is data on practical application of power line carrier channels.

FLOW OF COLUMBIA RIVER at automatic gauging stations will be available to load dispatchers on continuous strip chart by remote recording equipment. Depth at each station will be converted to actual flow by electro-mechanical networks



VOICE FREQUENCY MICROWAVE channel will transmit coded signal from dispatching headquarters to each station in rotation. Return depth signal will be transmitted to chart recorder to show quantity of river flow for each of the six stations

BPA to Record Automatically Flow of Columbia

DONALD L. WYLIE, Communications Design Engineer
Bonneville Power Administration, Portland, Ore.

Remote recording of Columbia River depth gage readings with automatic conversion to corresponding quantity of flow is expected to permit an increase in maximum obtainable energy from Coulee and Bonneville Dams without jeopardizing firm power commitments. The installation will utilize the Bonneville Power Administration microwave network and is designed to assist load dispatchers in controlling storage on the river.

Initial facilities will provide automatic and continuous transmission of river gage readings from the four U. S. Geological Survey stations, shown on the map, to dispatching headquarters at Ross substation, near Portland, Ore. Two future installations will be added to the system.

Send Out Coded Signal . . . Heart of the system will be a synchronous selecting mechanism located at Ross substation. It will send out coded station selecting impulses at 2½-min intervals. These impulses will be transmitted over a voice frequency telegraph channel sub-multiplexed on one voice channel of the microwave system. Individual river gaging stations will be connected to the microwave repeater network by wire line or radio link between the gage house and the nearest repeater location. A selector-type relay at each station will select the proper station code from the six codes received. This relay turns on an automatic measuring device and then transmits a coded signal over the microwave link to the converting and recording equipment. Each station will be interrogated in sequence, with a complete operating cycle of 15 min for the six stations.

Signals from the individual gage stations will be received in the form of coded digital pulses giving the river stage above mean datum level in feet and tenths. These impulses will be automatically connected to the correct channel input of a central stage-discharge converter. The electro-mechanical converting network for each channel is individually designed and calibrated to give the height vs flow conversion relationship for the particular gaging point. The converters are designed to allow for recalibration if necessary.

Data Is Recorded . . . Outputs of the individual converters, representing quantity of flow, are connected to the input of a six-channel continuous-strip chart recorder. Logarithmic scale of the recorder has a range of 10,000 cfs to 1,000,000 cfs, an ample range for accurate operation during even the most severe floods. The logarithmic scale also effects expansion of data for low water conditions, a valuable feature. Conversion accuracy of the complete system is specified as 2% or better for 10,000 to 100,000 cfs. It will decrease linearly to 5% at 500,000 cfs, a reasonable accuracy in view of possible variation in basic river flow data obtained by actual stream measurement.

Data from each station appears on the strip chart as a number of discrete points distinguishable from points of other stations by an identifying character. With the chart moving at ½ or 1 in. per hr, during which each station reports four times, the points will form six semi-continuous lines on the graph, giving the dispatcher a visual indication of river flow conditions at all times.

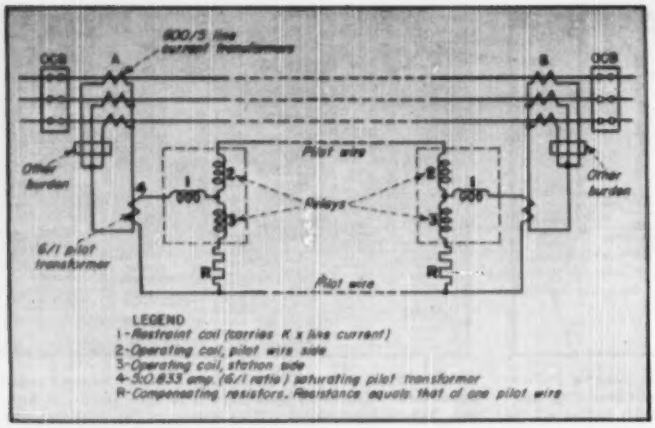


FIG 1—PERCENTAGE RELAYING was introduced in the differential pilot wire relaying previously used by addition of coil 1. Pilot transformer was changed to one with 6:1 ratio, and a special saturating characteristic 25% restraint is used

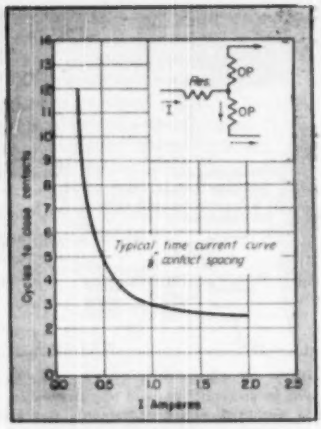


FIG 2—HIGH SPEED OPERATION is not provided but 4-cycle operation is adequate for company's 12-kv system

Current Transformer Differences Overcome With Percentage-Type Relay

Burden reduced on line current transformers by reducing pilot-wire current. Saturation characteristics make relay current independent of line current transformer characteristics. Extensive tests prove effectiveness of new relay

J. J. SAMSON, Senior Engineer, Station Design Div, Engineering Dept
E. L. MICHELSON, Section Engineer, System Planning Div, Engineering Dept
Commonwealth Edison Co, Chicago, Ill.

With the introduction of factory constructed switchgear supplied from several sources, it has not been possible on the Chicago system to install similar type equipment at each terminal of 12-kv distribution lines. Consequently incorrect operations of pilot-wire relays on the 12-kv distribution system was a possibility due to differences in current transformer characteristics.

To overcome this it was necessary to design a new relay which would be less subject to these differences. While the basic relay system was not being changed, the new relay does introduce the percentage method—widely used in other types of protective relays. Connections for the new system are shown in Fig 1. It is an induction disc-type relay, having two discs on a common shaft. The lower element (coil 1 in Fig 1) furnishes the restraint or opening torque. The upper element produces the operating or closing torque, which is supplied by the two coils shown as 2 and 3 in Fig 1.

The secondary current transformer has a 6:1 ratio and is designed to saturate for heavy fault currents. This transformer serves two purposes: (1) It reduces the pilot-wire current and thereby reduces the burden on the line current transformers, and (2) by its saturation characteristic it makes the relay current independent of the line current transformer characteristics during heavy through faults. On the average line length, the 6:1 current transformer saturates at about five times full load current.

Under normal load or through-fault conditions, the current divides equally through coils 2 and 3 and the ampere-turns of the two coils cancel. Minimum closing current, with current in only one coil—or a difference in the currents through the two coils—is 0.25 amp. In terms of the system fault currents required to cause tripping, this amounts to 360 amp for circuits using 600/5 current transformers. In other words, it requires a fault current equal to 60% of the full load current to trip the relay. On heavy through faults, the restraint coil produces an opening torque which amounts to 25% of the through current. As a result of this restraint torque, and the saturation of the 6:1 current transformers, it is not necessary to match line current transformers. Also, the induction principle

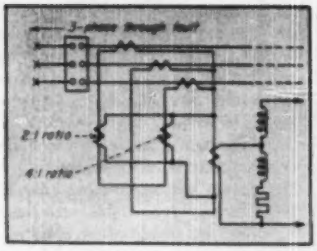


FIG 3—THREE-PHASE PROTECTION was provided in the original relay system with unequal ratio current transformers that were installed on one end of the line

makes the relay practically immune to transient conditions. It is expected that this relay will provide very reliable service under all conditions.

Not High Speed . . . This relay does not provide extremely high-speed operation as can be seen from the current-time characteristics as shown in Fig 2. However, the maximum speed of about four cycles is adequate for the conditions on the company's 12,000-v system.

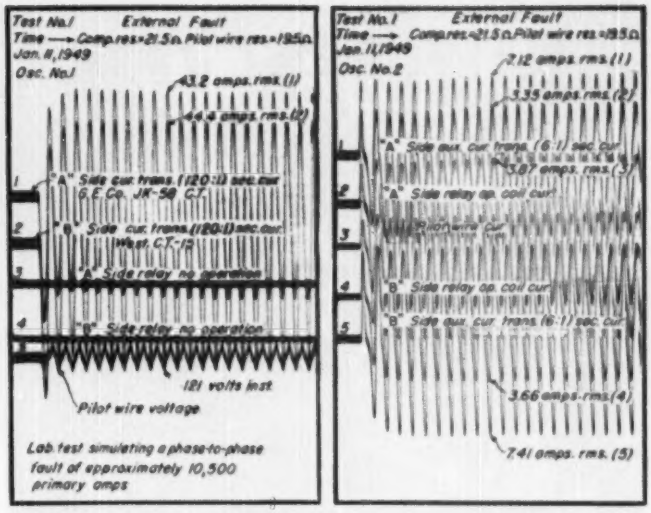
Tests made on the relay scheme covered all types of faults and a range of currents up to 20,000 amp. On the heavy current tests, the maximum dc component was obtained to attain the full effect of offset currents. Also, the pilot circuits were unbalanced to simulate the worst condition of temperature change. First oscillogram shows the results of an external fault test of 11,500 amp, and second oscillogram for an internal fault. Results of the tests were very satisfactory and indicate that the relay will provide reliable performance under all anticipated conditions.

Relaying Pattern for 12-kv . . . On the Chicago 12-kv system extensive use is made of pilot-wire relaying because most large industrial customers are supplied from 12,000-v loops, each serving a number of customers. While these loops could be protected by the use of conventional overcurrent and directional relays, this method of protection would lead to excessive time settings. By the use of differential pilot-wire relays, the tripping time for faults in the loop can be kept within reasonable limits.

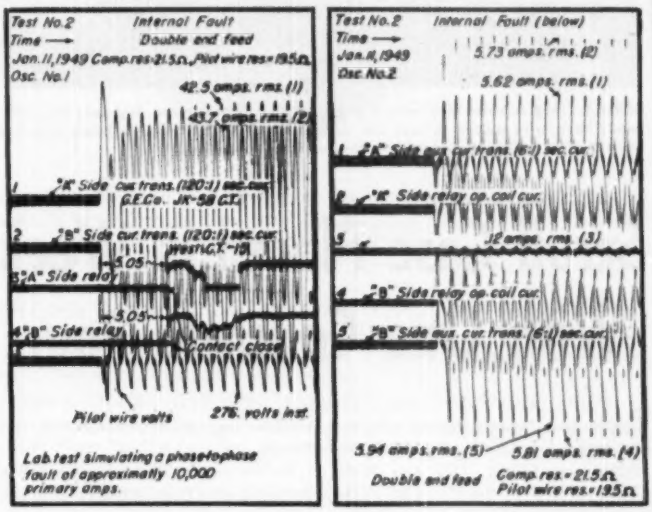
The basic scheme used was similar to that shown in Fig 1 but without the percentage arrangement which is provided by coil 1 and with current transformer ratio of 1:1 instead of 6:1. This arrangement provides protection for ground faults only, but since these constitute a large percentage of the total number of faults, the system has provided satisfactory service. Details of operation of this method of relaying were described in 1943 in an AIEE paper entitled, "Pilot-Wire Relaying on a Metropolitan System" by Messrs. LeClair and Michelson. Under fault conditions, currents circulate in the pilot-wires; during a through fault, the currents in the two halves of the relay coil are equal and opposite; while during an internal fault the relay currents are not balanced.

This scheme of relaying was adapted for protection against phase faults by the use of the connections shown in Fig 3. The auxiliary cur-

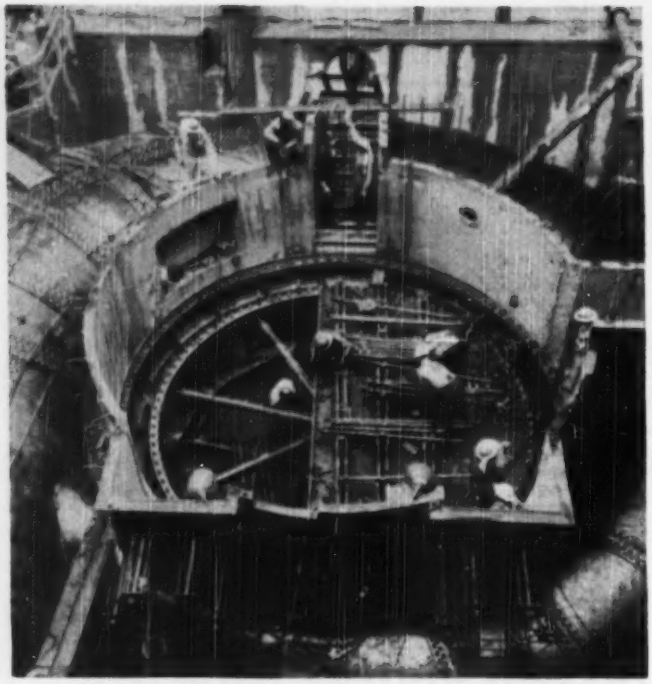
(*Continued on page* 151)


Test No.1 External Fault
Time → Comp.res=21.5Ω Pilot wire res.=195Ω
Jan. 11, 1949
Osc. No.1
43.2 amps. rms. (1)
44.4 amps. rms. (2)
"A" Side cur. trans. (120:1) sec. cur. G.E.Co. JK-58 C.T.
"B" Side cur. trans. (120:1) sec. cur. West. C.T.-12
"A" Side relay op. operation
"B" Side relay op. operation
121 volts inst.
Pilot wire voltage
Lab. test simulating a phase-to-phase fault of approximately 10,500 primary amps
Test No.1 External Fault
Time → Comp.res=21.5Ω Pilot wire res.=195Ω
Jan. 11, 1949
Osc. No.2
2.12 amps. rms. (1)
3.35 amps. rms. (2)
"A" Side aux. cur. trans. (6:1) sec. Cur.
3.87 amps. rms. (3)
"A" Side relay op. coil cur.
Pilot wire Cur.
"B" Side relay op. coil cur.
"B" Side aux. cur. trans. (6:1) sec. Cur.
3.66 amps. rms. (4)
7.41 amps. rms. (5)

EXTERNAL FAULT, phase-to-phase, results as recorded on oscillogram show circuit was not tripped. This indicates proper relay operation for this condition


Test No.2 Internal Fault
Time → Double end feed
Jan. 11, 1949 Comp.res-21.5Ω, Pilot wire res=195Ω
Osc. No.1
42.5 amps. rms. (1)
43.7 amps. rms. (2)
"A" Side cur. trans. (120:1) sec. cur. G.E.Co. JK-58 C.T.
"B" Side cur. trans. (120:1) sec. cur. West. C.T.-15
5.05
"A" Side relay
5.05
"B" Side relay
Contact close
Pilot wire volts
276. volts inst.
Lab. test simulating a phase-to-phase fault of approximately 10,000 primary amps.
Test No.2 Internal Fault (below)
Time →
Jan. 11, 1949
Osc. No.2
5.73 amps. rms. (2)
5.62 amps. rms. (1)
"A" Side aux. cur. trans. (6:1) sec. cur.
"A" Side relay op. coil cur.
12 amps. rms. (3)
"B" Side relay op. coil cur.
"B" Side aux. cur. trans. (6:1) sec. cur.
5.94 amps. rms. (5)
5.81 amps. rms. (4)
Double end feed
Comp. res.=21.5Ω
Pilot wire res.=195Ω

CIRCUIT TRIPPED on phase-to-phase internal fault for proper relay operation



SCROLL CASE is embedded with a single concrete pour in one day once the bulkheads have been placed to seal out water. Here, top bulkhead is being installed while bottom bulkhead and spiders have already been placed

Scroll Case Placed in Week With One Concrete Pour

Thanks to a new continuous concreting technique, scroll case of hydro turbines at Center Hill and Wolf Creek projects of the Corps of Engineers are being placed in one week instead of five.

Formerly, the 150-ton scroll case was embedded with 1,400 cu yd of concrete in 10 shallow pours three or four days apart. Now the job is done in a single pour in one day. To do this in one pour, top and bottom of the case were sealed off by bulkhead plates. Water from the reservoir was allowed to enter the penstock and scroll case, building up the normal working pressures.

Advantages gained by this procedure developed by H. B. Elder, resident engineer at Center Hill, are these:

1. Weight of the water prevents the scroll case from "floating" upward in the concrete to cause misalignment.

2. Water pressure prestresses the scroll case while the cool water simultaneously shrinks the case in accordance with operating temperature, correcting for elastic deformation.

3. Water-tightness can be checked and recaulking done under pressure. This is particularly desirable with a butt-strapped joint type of scroll case which is difficult to check for water-tightness by "in-the-dry" methods.

4. Provision is made to circulate the water within the scroll case so that the concrete's heat of hydration will be dissipated.

5. The circulating water helps keep the case aligned during the concreting operation by reducing the distortion that would otherwise be caused by changes in ambient temperature.

6. Alignment checks can be made while concrete is being placed.

Bulkheads are constructed entirely of commercially available structural shapes and are devoid of any machine work other than the drilling of bolt holes. Weight is about 25 tons. Transportation is facilitated by a split sufficiently off center to clear the spider hubs.

Comprising the bulkheads are two 1¼-in. steel plates, one attached to the upper bolt circle of the speed ring and one attached to the lower bolt circle. The plates are connected by 2¼-in. diam stay rods about 2½ ft apart. The stay rods extend through stiffeners, mounted on the outside of each plate, consisting of 8-in., 11½-lb channels back-to-back. Plates are sealed against ⅛-in. sheet rubber gasket material. Stay rods are sealed with rubber ring gaskets compressed into a beveled edge of plates which are welded top and bottom on pipe sleeves placed around each stay rod. Two eight-legged spiders within the bulkhead hold the speed ring in true round; one is placed directly beneath the top plate and the other directly above the bottom plate. The spider legs are 6-in. extra heavy pipe mounted on a central hub and with built-in jack screws at the outer ends.

A 6-in. pipe, properly gasketed, forms a hole entirely through the center of the bulkhead for the piano wire center line from which measurements may be taken for alignments. Ten evenly spaced slots cut in the outer edge of the top plate permit a micrometer rod to rest on the machined surface of the upper bolt circle of the speed ring so that level checks can be made.

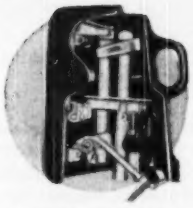
Water is circulated throughout the scroll case by opening a 6-in. valve mounted in the lower plate and discharging into the draft tube. Weight of the water confined in the scroll case is supported by 10 concrete saddles spaced midway between the pipe jack supports that support the case itself. The bulkhead is supported to carry the weight of the confined water with four bents formed by 8-in. channels and welded by clip angles to the bottom of the draft tube liner.

INDICATING

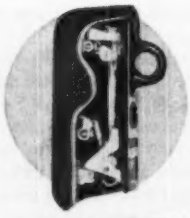
ONLY G-E OFFERS YOU··

Four Cutouts in one!

DROP-OUT



RECLOSING



DISCONNECT

And that's only half the story! By stocking only three interchangeable doors which fit *both* 5.2 and 7.8 kv, 50-ampere housings, you get the 4 operating functions illustrated at left—a total of eight essential cutout combinations! Available also in 100-ampere ratings, this unique flexibility reduces inventory and simplifies stocks.

INDICATING OR DROPOUT WITH A TWIST OF THE WRIST!

A small wire yoke, easily inserted or removed, determines whether the fuse-holder door "kicks out" at the bottom for visual indication, or drops open—either way giving positive evidence of a blown fuse.

RECLOSING DOOR AVOIDS UNNECESSARY SERVICE TRIP!

The two-element reclosing door restores service within one second after a temporary fault blows the first fuse link. By avoiding an extra service trip, it pays for itself the first time it operates!

FLEXIBLE DISCONNECT BLADE CAN'T GET LOST!

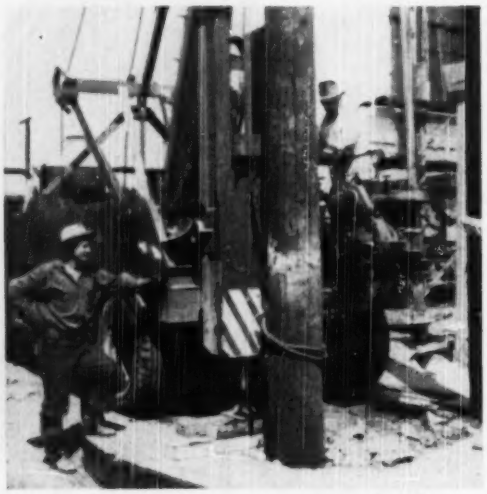
It's fastened to the door—can't be misplaced. This disconnect blade doubles the continuous current rating of the cutout. When the blade is disconnected and the door closed, the flexible cable extends downward to indicate that the circuit is open.

For complete information contact your G-E sales representative. Apparatus Dept., General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

EXTENDABLE HYDRAULIC BOOM can be rotated to support loads over an earth-borer or hydraulic pole puller mounted on the rear of the truck. The boom extends to 38 ft 3 in. and can place transformers up to 250 kva, 34,000 v on racks which are located as high as 30 ft above ground



HYDRAULIC POLE PULLER develops up to 50,000-lb pull by reaction on the ground, leaving truck body free of load. This capability is believed adequate to remove any pole on the system. Hydraulic pressure of 1,000 psi is supplied by a pump driven by truck motor. Pole can be removed in 20 min

Hydraulic Boom and Puller Combined with Earthborer

FLOYD L. GOSS
Engineer of Overhead Distribution
ELLIS W. TEMPLING
Automotive Engineer
Los Angeles Dept of Water and Power
Los Angeles, Calif.

Increased efficiency and safety in pulling and setting of poles has been realized by Los Angeles Department of Water and Power in a combination earthborer, hydraulic pole puller and hydraulic extendable boom. All this equipment is mounted on a four-wheel-drive truck. With this equipment a job which with old methods would have required an hour to set up, pull, and lay a pole on the ground can be done in 20 min.

Earthborer and hydraulic pulling apparatus are mounted side by side on the rear of the truck, and the boom is mounted on a base which allows rotation so it can support a load over either. This feature facilitates setting and removal of poles where it is necessary to keep the pole from contacting energized conductors in the vicinity.

Boom is extended, rotated, and held in position by hydraulic pressure of 400 psi, supplied from a pump driven by truck motor. Load is lifted by a three-drum winch, the two outside drums being used to control boom stay wires.

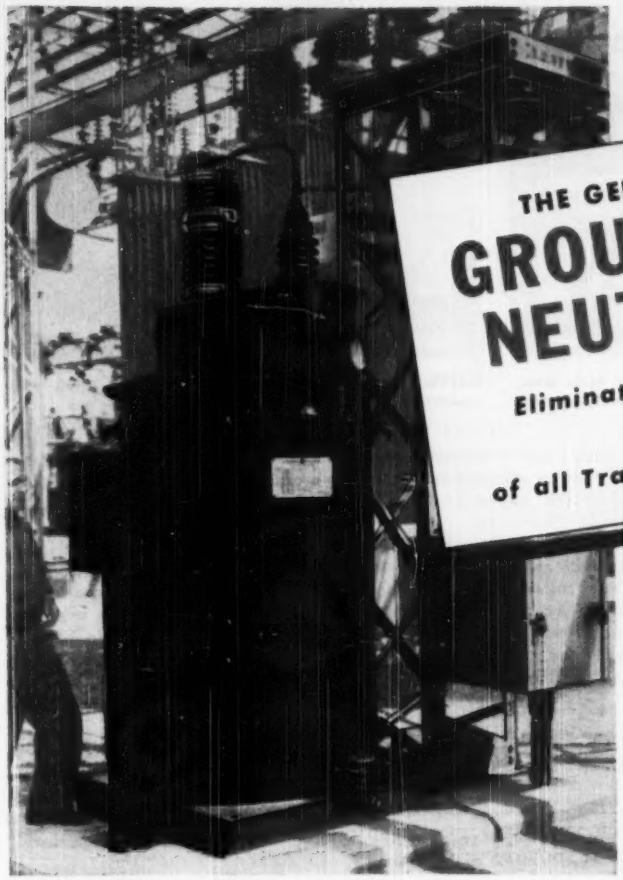
Boom Lifts 7,500-lb Load

Loads up to 7,500 lb can be lifted by the boom to a height of 38 ft 3 in. Thus the boom can be used to place transformers up to 250 kva, 34,500 v on racks located 25-30 ft above ground. In traveling position overall length of equipment is 35 ft and maximum height is less than 13½ ft, the legal limit in California.

Pole puller is a hydraulic cylinder arranged to pull by direct reaction on the ground rather than by reaction on truck body. It is designed for a maximum hydraulic pressure of 1,000 lb, which gives a pulling force on the pole of approximately 50,000 lb. This capability (including safety factor) is believed adequate to pull any pole on the system.

Use of the puller and boom eliminates the hazard of a winch line failing before a pole is pulled free by a winch. It also eliminates the tendency of a pole to sway from side to side when jacks alone are used, as well as making the job much easier to set up and complete.

This equipment was designed by the engineering section of the department's general plant division and assembled on the truck chassis in the department shops.

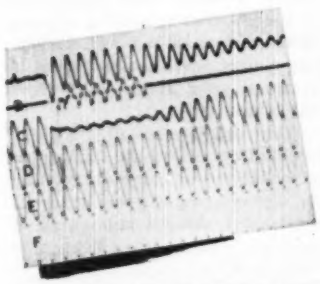


THE GENERAL ELECTRIC

GROUND-FAULT NEUTRALIZER

Eliminates Tripping Breakers on 50 to 80% of all Transmission System Faults

The ground-fault neutralizer is basically an oil-immersed reactor, insulated for line-to-neutral voltage, which is connected between the neutral of a transformer and ground. Its inductive reactance is tuned, by means of a motor-driven tap-changing switch, to approximately equal the capacitive reactance of the system. In the case of a transitory line-to-ground fault, the current passed by the reactor neutralizes the system charging currents from the two unfaulted phases. Any remaining current is small and is practically in phase with the line-to-neutral voltage. Since current and voltage reach zero almost simultaneously, the arc is extinguished without restriking—without an outage, and without even a momentary disturbance of line-to-line voltage.



The effectiveness of the ground-fault neutralizer is well shown by this oscillogram taken during a transitory ground fault on a 69-kv system. It shows how the arc was quenched after a few cycles, without restriking; system line-to-line voltages were not noticeably disturbed. A = neutralizer current, 26 amp. B = fault current, 10 amp. C = line-to-neutral voltage of faulted phase. D, E, and F = line-to-line voltages.

The General Electric ground-fault neutralizer is a protective device that quenches non-persistent line-to-ground faults in a few cycles and limits fault current to a few amperes. Thus, it prevents interruption of service during 50 to 80 per cent of all transmission system faults.

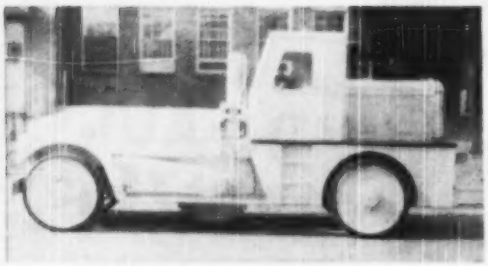
While this device has been well known in Europe for a great many years, it has only been recently that its many advantages have been widely recognized in this country. Compared to isolated-neutral systems, it eliminates high transient overvoltages that often result in flashovers at remote sections of the system. Compared to the solidly grounded system, it prevents service interruption, minimizes burning at the fault. Breaker operations are fewer, breaker maintenance is reduced.

In the belief that you will be interested in knowing more about the ground-fault neutralizer, we have revised our 16-page bulletin describing it. Ask your G-E sales representative for GEC-586, or write *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

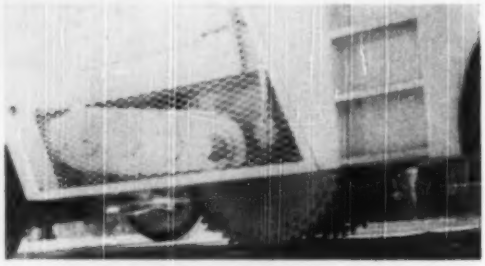
GENERAL ELECTRIC

401-99

Self-Propelled Pavement Cutter Reduces Noise



PAVEMENT CUTTER triples speed and reduces noise associated with former mechanical methods of pavement removal



CUTTERS ARE LOWERED, can cut dual slots in 15-in. thick concrete at speeds varying from 5 in. to 5 ft per min

Use of a new type of automotive operated machine has brought speed and comparative quietness to the operation of pavement cutting. This machine was "tailored" to the requirements of The Cleveland Electric Illuminating Co. It was developed jointly by the utility and Joy Manufacturing Co, Franklin, Pa.

By a recent test the machine is expected to triple the speed and halve the utility's cost of mechanized pavement removal operations. (See Electrical World, August 27, 1949 page 91).

The 15-ton machine and the cutting wheels are powered by one 75-hp gasoline engine. The unit can be driven to and from the job at speeds up to 12 mph. More than 250-gal of water are carried to prevent dust and to cool the cutting bits.

Cutting elements are two large wheels carrying carbide-tipped bits, are raised and lowered hydraulically, and cut dual slots in 15-in. thick concrete. In actual pavement cutting the machine can move at rates of 5 in. to 5 ft per min. Rate of advance through 8-in. concrete with mesh reinforcement, as normally used in highway construction, has been established at 1 ft per min or more.

Identify Coal Shipments Rapidly With Cross-Index

J. ERNEST RHOADES
Chief Chemist
Twin Branch Plant
Indiana & Michigan Electric Co
South Bend, Indiana

1		2		3		7		8		9	
135,987	10	204,768	9	301,250	8	730,120	3	800,120	2	972,564	1

CAR NUMBER from railroad car is listed in the column headed by the first digit of that car number. Alongside this number is the index number assigned to the shipping notice. Identification of a car of coal by this method is quite simple

Speedy identification and unloading of incoming railroad coal cars may be secured by cross-referencing car numbers and "index numbers" of shipping notices. Identification is required to permit proper preparation and labelling of composite samples, to prevent unloading coal delivered in error, and to allocate coal when necessary.

Each shipping notice, which lists railroad car numbers, usually covers only one day's shipment of one size of coal from one mine. Therefore, an accumulation of sheets usually results. Since cars do not always arrive in their initial order, identification of coal deliveries formerly required searching through many shipping notices, causing delays in unloading the coal.

To overcome these difficulties, which are accentuated during heavy shipments, the following procedure has been adopted: When shipping notices are received they are numbered in sequence disregarding the shipping dates. The serial numbers, serving as an index, continue for a month before repeating. Each day's notices are then relisted on a 9 x 14 in. sheet, divided into nine main columns, headed 1 to 9 inclusive. Each car number is entered in the column headed by the first digit of that car number; car initials are disregarded. Alongside the car number is inserted the proper shipping notice serial (index) number.

This listing greatly reduces the number of records to be examined to identify a car of coal. Lists of car numbers with corresponding shipping notice numbers are kept with the shipping notices, which are maintained in numerical order at the point where coal is received.

When coal is received, it is easily identified by locating the car number on the ruled sheet and then observing the corresponding shipping notice index number. After a railroad car is identified, a line is drawn through its number on the ruled sheet and a checkmark made on the shipping notice. When all numbers have been marked off the ruled sheet, it is discarded.

NO OVERHEATING . . .
LESS OXIDATION . . .
YOU SAVE 10—15% WITH

SILVER CONTACT SURFACES AT NO INCREASE IN PRICE

POWER CONNECTORS

SILVER is used exclusively on *all* General Electric connectors because it allows power to flow between conductor and connector with minimum losses, and avoids overheating.

Maintenance is reduced, since there is no troublesome copper-oxide formed. Oxide formation causes overheating which in turn hastens oxidation; a vicious cycle that may cause the connector to fail. When you use G-E connectors with silver contact surfaces, the cycle can't even get started.

CORRECT MATERIAL for the job is another feature assuring you that G-E connectors "run cool." The composition of the alloy used permits the connectors to carry the maximum current of any conductor . . . cable, tubing or rod . . . without overheating.

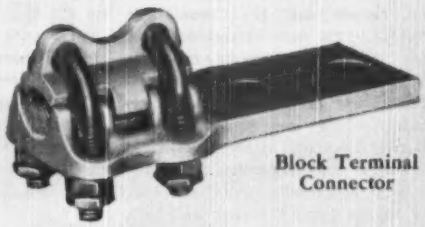
By using General Electric connectors you're assured of long connector life because of silver contact surfaces and correct material for the job—double safeguards against oxidation troubles, and they don't cost you a cent extra.

CHECK THESE ADDITIONAL FEATURES . . .

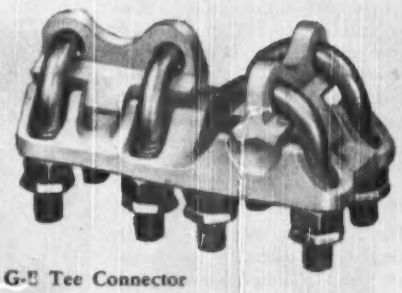
SERRATED CONTACT SURFACES give high grip strength and a permanent, high-conductivity joint that will resist vibration and give positive pressure on the conductor at all times.

NON-CORRODIBLE HARDWARE is of high-strength bronze alloy that maintains pressure during long service. G-E connectors will not twist, distort, or season crack.

INTERLOCKING SIDES confine the conductor within the connector enclosure, thus obtaining full advantage of the conductor's current-carrying capacity.



Block Terminal Connector



G-E Tee Connector

Place an order today with your G-E sales representative and start realizing the many benefits to be gained by using General Electric connectors. Also, write for a copy of publication GEC-400 that contains 40 pages of valuable information on G-E connectors, and see for yourself how easy they are to order. Write to *Apparatus Dept., Section 856-55, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

Heavy Roller Destroys Right-of-way Underbrush

W. P. CARTER
System Transmission Line Supt
Appalachian Electric Power Co
Bluefield, W. Va.

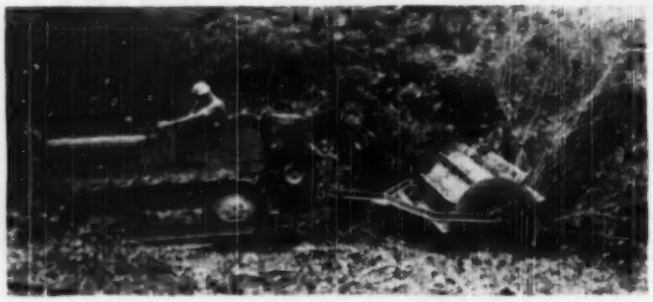
To speed up the periodic reclearing of right-of-way, we devised a method of doing this work mechanically with a roller which not only speeded the operation but also reduced costs. The roller is very effective for cutting both large and small growth.

Major advantages of the cutting roller, used in conjunction with a diesel tractor, over the brush hook or disc harrow are: (1) Considerable damage to the roots of stubble and a large amount of uprooting resulting in slower growth; (2) more speed and effectiveness because a certain percentage of the growth is killed; (3) effective operation either forward or backward. By this method of cutting, 41 miles of right-of-way from Fieldale, Va., to the North Carolina state line, were cleared at an average cost of $130 per mile as compared to a contract price of about $200. Included in this $130 is labor, expense of the crew, operating cost of the truck and tractor, and necessary hand work such as cutting under towers, along fence lines, creek banks and ditch lines adjacent to roadways.

Equipment Has 66 Cutting Blades

The equipment illustrated has 33 cutting blades attached to the tractor cleats and 33 cutting blades attached to the roller. Thus the equipment can be used wherever it is possible to drive the tractor. With the blades attached to the cleats of the tractor, terrain can be cleared which would be inaccessible to other equipment. This method of clearing has been tried on all types of soil—rock, sand, clay, and loam—and so far has not caused any erosion along the right-of-way. It will not perform when snow is on the ground.

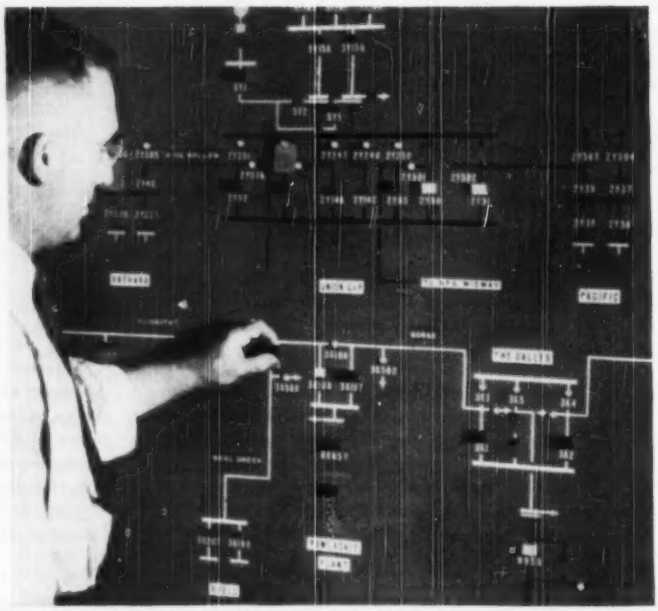
To cut various types of brush, the weight of the roller can be varied from 3,918 lb (empty) to 7,360 lb by filling it with water. To lighten the load during transportation, the water is drained from the roller. Weight and size of the tractor also must be considered because of weak bridges and narrow roads in the area. Preferred tractor is one that may be carried by truck over the poorest secondary roads.



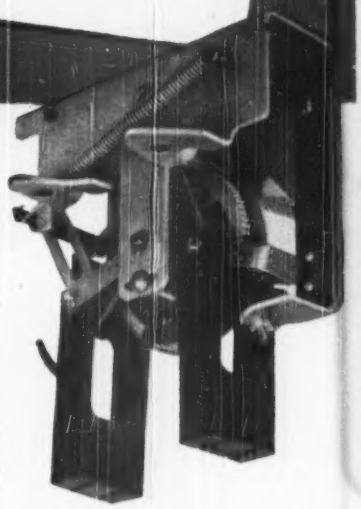
RECLEARING RIGHT-OF-WAY with 33-blade roller and tractor. Tried on soil-rock, sand, clay and loam, the equipment has not as yet caused erosion along right-of-way

All materials, labor and expense involved in making the roller, totaled $1,800. A steel drum 41½ in. diam and 6 ft long was used. Other material includes 33 cutting blades, 132 angle clips, 7 steel bars used in the construction of the tongue, a steel axle, a steel pipe, a swivel coupling hitch, 4 steel sections, and 66 cap screws with nuts and washers.

Magnetic Symbols Used on Steel Board



ALNICO MAGNETS of different shapes and colors serve as circuit breaker, disconnect switch and other standard symbols on this new dispatching board in the Portland, Ore. headquarters of Pacific Power and Light Co. Board is made of thin sheet steel; circuits are put on with removable colored tape. Transformer symbols are cut from colored tape with a pair of ordinary pinking shears



YOU GET POSITIVE CO-ORDINATION—WITH BREAKERS, WITH RECLOSERS IN SERIES, AND WITH FUSES

The rugged mechanical timer of the FR-1 operates in air. Its time-current characteristics remain exactly as published regardless of temperature, or viscosity changes of oil.

Holds Service Trips to Minimum

The FR-1 resets in a matter of seconds. You avoid unnecessary fuse blowing and recloser lockouts from rapidly recurring faults.

Picks Up the Load Easily

Inrush current can't lockout the FR-1. It has an exclusive "time-delay" function—holds closed until inrush currents have subsided, then automatically resets for normal operation. This also permits the use of fewer sectionalizing points—makes possible a saving in system investment.

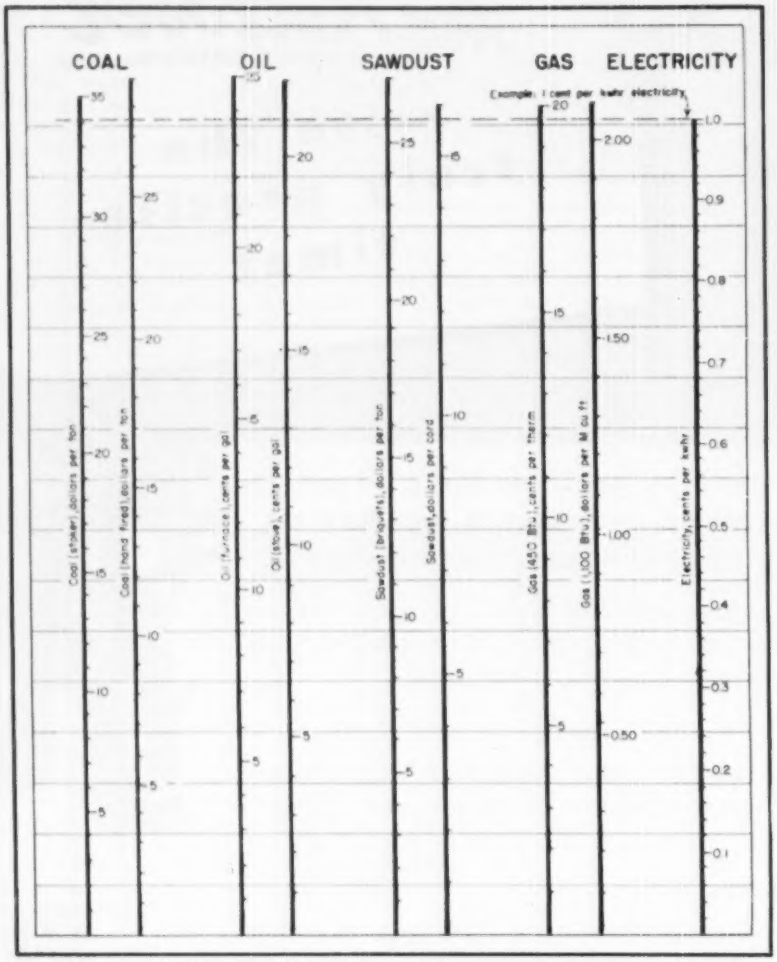
No other recloser combines all the essential features of the FR-1. For a more complete story, write for GEA-4934. Address your nearest G-E Apparatus Sales Office or *Apparatus Dept., General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

033-50

Equivalent Domestic Fuel Costs

GEORGE H. PIKE, Rate Engineer, Washington Water Power Co, Spokane, Wash.



ON THE SINGLE BASIS OF EFFICIENCY of energy utilization in ordinary home heating, without consideration of investment, maintenance and other charges, cost of electricity for house heating compares with costs of combustion fuels as shown here. This nomogram was erected on the following data. An example on full costs is shown at top of the nomogram

Heat Source and Unit	Btu Per Unit	Efficiency Of Utilization, %
Coal—Stoker fired, lb	13,500	45
Coal—Hand fired, lb	13,500	35
Oil—Furnace, gal	140,000	55
Oil—Stove, gal	137,000	50
Sawdust—Briquets, lb	8,500	50
Sawdust—Loose, cord	14,300,000	45
Gas—Manufactured, cu ft	450	65
Gas—Natural, cu ft	1,100	65
Electricity, kwhr	3,413	95

SPIRAKORE®
TRANSFORMERS

Built to Live with Lightning

ROUGHLY HALF OF ALL DISTRIBUTION TRANSFORMER FAILURES CAN BE CHARGED TO LIGHTNING. That's typical experience. However, in Spirakore® transformers delivered since late 1943, lightning failures have been almost insignificant!

There's a reason for this. Back in 1943 G-E research facilities enabled our engineers to make important discoveries about impulse strength. As a result, design improvements were made in small, low- and medium-voltage distribution transformers. The new G-E transformers—built to live with lightning—are improving operating records all over the country.

In all respects Spirakore leads the field. It's the finest distribution transformer we have ever made—the finest you can buy.

Apparatus Dept., General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

Guy Loading at Angles and Dead Ends In Rural Distribution Lines

Tables give wire load at position of guy attachment for various sizes of line conductors and guy wires. Data are an adaptation from Distribution Specifications of West Penn Power Co

TABLE I—Unbalanced Wire Load at Guy Attachment and for Various Sizes of Conductors

Line conductor size and kind	Voltage class	Unbalanced wire load in pounds per line wire at position of guy attachment on angle or dead-end pole-guy attached 18 in. to 24 in. from pole top* (Line angles shown as "pull" measurement in feet)											
		5 ft (6°)	10 ft (11°)	15 ft (17°)	20 ft (23°)	25 ft (29°)	30 ft (35°)	35 ft (41°)	40 ft (47°)	45 ft (53°)	50 ft (60°)	60 ft (74°)	70 ft (89°)	Dead End
No. 6 Bare Copper	Primary	210	280	340	400	470	530	590	650	710	760	860	950	670
No. 4 Bare Copper	Primary	340	440	520	620	720	820	910	1,000	1,090	1,170	1,330	1,460	1,040
No. 6A Copperweld-Copper	Primary	470	630	750	900	1,050	1,190	1,340	1,470	1,600	1,730	1,960	2,170	1,550
No. 4A Copperweld-Copper	Primary	610	820	980	1,170	1,360	1,550	1,730	1,910	2,080	2,240	2,540	2,810	2,000
No. 4 ACSR (6 Strand)	Primary	460	600	710	840	970	1,100	1,220	1,340	1,460	1,570	1,770	1,950	1,370
No. 2 ACSR (6 Strand)	Primary	600	830	990	1,180	1,370	1,560	1,740	1,920	2,090	2,250	2,550	2,810	2,000
No. 6 Bare Copper	Secondary	180	230	270	320	370	420	460	510	550	600	680	750	530
No. 4 Bare Copper	Secondary	270	360	410	480	570	640	720	790	860	920	1,040	1,150	820

* When guy is attached at secondary, use primary wire loading for secondary wires.

Note: In applying field measurements, use next higher "pull" column in Table I and next lower "lead/height" column in Table II.

TABLE II—Unbalanced Wire Load at Guy Attachment and for Various Sizes of Guy Wires

Guy wire, size and class	Unbalanced wire load at position of guy attachment on angle or dead-end pole which can be supported by different guy installations				
	Ratio of "Lead" to "Height" of guy wire				
	1/2	3/4	1	1 1/2	3 or more
1/4 in. HS Copperweld	2,025	2,535	3,200	3,765	4,290
11/32 in. EHS Copperweld**	3,820	5,115	6,025	7,100	8,080
7/16 in. EHS Copperweld	6,600	8,860	10,430	12,300	14,000
1/4 in. HS Galvanized	1,760	2,360	2,780	3,280	3,730
3/8 in. HS Galvanized	4,225	5,670	6,680	7,860	8,960
1/2 in. HS Galvanized	7,350	9,860	11,620	13,700	15,600

** This is 3—No. 6 E.H.S. Copperweld

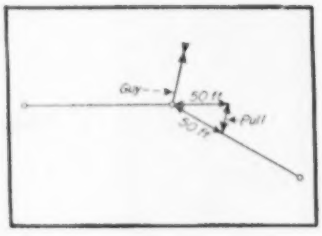


FIG 1—A SINGLE GUY may be used for 60-70 ft "pull" if right of way conditions permit and the line will not be extended ◀ in either direction outside the angle

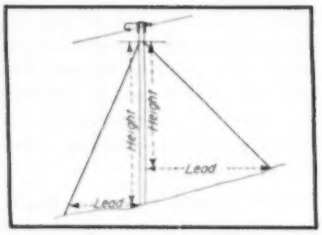


FIG 2—METHOD OF MEASURING "lead" and "height" for determining size of guy wire in Table II ▶

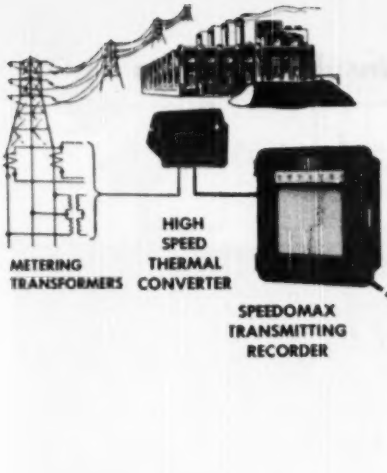
Example . . . Line Angel: Pull = 27 ft. (See Fig 1)

Wire Lead: Primary, 2 No. 4A Copperweld-Coppere guy installation (see Fig 2). "Lead/Height" = 1.

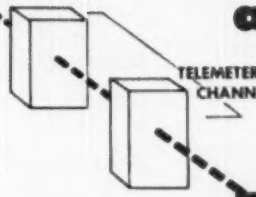
Determine Size of Guy Wire: Obtain total wire load for 30-ft, "pull" in Table I.

Wire Load = 2 × 1,550 = 3,100 lb. Compare 3,100 lb with values for "Lead/Height" = 1 in Table II.

This requires an installation of one 1/4-in. Copperweld guy or one 3/8-in. galvanized guy.



Long-Distance Telemetering That's Fast and Accurate



- **High Accuracy**
- **Fast Response**
- **No Synchronization**
- **Wide, Detailed Record**
- **Works Over Any Distance**
- **Built-in Checking Features**

Power companies are getting any load facts they need from anywhere in the network—in just a few seconds—by using Speedomax Impulse Telemeters. This equipment works with any kind of telemetering channel—telephone circuit, carrier current or microwave link—and can operate over any distance within the capabilities of the channel.

At the sending end, a Speedomax recorder measures electrical load by means of a high speed thermal converter. It translates the load reading into regularly spaced impulses, whose duration varies with recorder reading. Impulses are transmitted by carrier or other channel to a Speedomax receiving recorder in the dispatcher's office. This Speedomax translates the impulses back into a continuous load measurement, duplicating the record of the transmitting recorder.

Response time is so short that the receiving recorder begins to show load swings within two seconds from the instant that load changes at the metering point. Accuracy is so high that charts from transmitter and receiver cannot be distinguished from each other. Every detail of load variations is readily visible on the 9⅞-inch wide Speedomax chart—a big help to the dispatcher in studying trends and making forecasts.

The Speedomax equipment needs practically no coordination with the telemetering channel. It can be used with any commercial carrier or microwave system. There are no synchronization problems, for the Speedomax receiver automatically keeps in step with the transmitter. Speedomax transmitter and receiver can operate from power sources of different frequencies. Built-in features help in checking the complete system. Failure of the telemetering impulse is indicated by a signal light on the Speedomax receiver. The telemetering channel can be checked and calibrated by means of integral adjustments, without the use of meters.

Speedomax Telemeters can be equipped with various control devices and incorporated directly into existing load-frequency control. For details about the equipment, write to Leeds & Northrup Company, 4938 Stenton Avenue, Philadelphia 44, Pa.

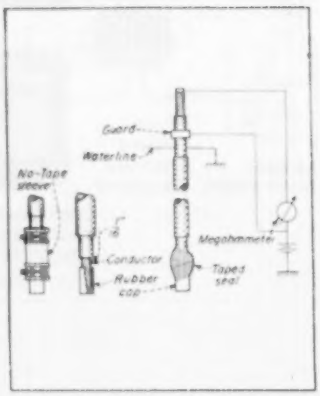
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad ND46-58-461(1)

Water-Tight Sealing of Cable Insulation Joints

RELIABLE SEALS were produced, irrespective of personal skill, with only one tape and with mechanical sleeves. A seal was called a failure if insulation resistance fell below 100,000 megohms. Failure does not necessarily mean that water entered



TEST SET-UP measured cable insulation resistance to detect entrance of moisture. Test seal and mechanical sleeve shown

W. F. BONWITT
Quality & Research Engineer
Burndy Engineering Co, Inc
New York, N. Y.

Comparative effectiveness of tape-sealed joints and mechanical sleeves has been evaluated in recently completed investigations. The objective was to determine the most practical manner, ie, the one least sensitive to personal skill, and the most suitable taping material for making water-tight taped joints between rubber-insulated ac secondary network cables and the insulated outlets of a typical underground connector.

Need for such developmental investigations lay in the increasing number of underground installations involving cable joints and cable terminations at connectors. The taping operation has thus become of major importance, especially since manholes, transformer vaults, and cable ducts very frequently may be exposed to flooding.

Investigation showed that it is possible to produce a reliable watertight seal by taping, as well as with mechanical sleeves. However, only one of seven tape combinations produced such a seal. No such selectivity was found with the mechanical sleeves used. In general, a seal that stood up for the first four or five weeks remained satisfactory throughout the year-long test. Results of the investigation are summarized in the accompanying chart.

Test opening to be sealed was a $\frac{1}{16}$-in. gap between a straight length of Type R rubber-covered 500-Mcm cable and the open end of a rubber cap pushed over the bare cable end. The cap was molded from the same compound as is used for insulated underground connectors.

Selection of the sealing means was made with a view of testing the most widely used tapes for rubber covered cables. There were three rubber-base tapes (A, B, and C), a Neoprene-base tape over a rubber-base tape, and two types of plastic pressure-sensitive tapes. Manufacturers' recommendations were followed when applying the tapes except for variations listed in the chart.

Test Procedure

Three test samples were continuously immersed in 20 in. of salt water. Periodic measurements of cable insulation resistance provided a sensitive means for detecting the entrance of moisture through the joints. A test group was considered to have failed when insulation resistance of a sample of that group dropped below 100,000 megohms. Thus, the seal over the insulation gap had to be of the same magnitude as the cable insulation itself.

Elapsed time between immersion and failure—or the end of the one-year observation period—is shown on the bar graph for two of the three samples in each group. The third sample was removed after one week. Its disassembly permitted moisture content of the sample to be correlated with the observed change in insulation resistance. A drop in insulation resistance showed up a poor seal in a comparatively short time. After this initial drop, poor seals showed a low, but stable, resistance level.

The only taped group that stood up satisfactorily consisted of samples sealed with rubber-base tape "A". Standard taping procedure was followed in preparing the insulations and applying this tape. After thoroughly cleaning insulation on cable and cap, a thin even coat of rubber cement was applied and allowed to dry for a minute. Half-lapped layers of tape "A", applied with enough tension to reduce tape width by one-third, was built up to roughly 1½ times cable insulation thickness. Rubber tape overlapped the two insulations about ¾ in. on each side.

Friction tape, extending slightly beyong the rubber tape, was applied with considerable tension in two half-lapped lapers. Entire sleeve was covered with waterproof insulating paint.

Continuous immersion may not be equal in all respects to service conditions with alternate immersion and drying periods, expansion and contraction due to thermal changes, and other effects. But it seems reasonable to consider a full year's immersion a very severe test.

What goes into MOLONEY TRANSFORMERS comes back to YOU in profits

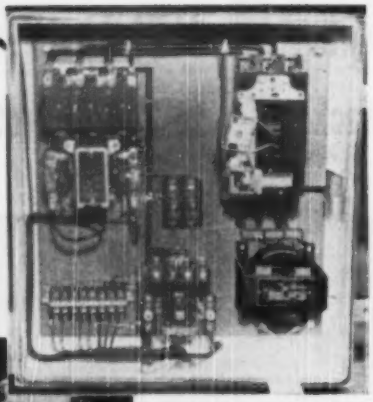
It is the quality of materials that go into a tranformer... plus the skill of the engineers and craftsmen who design and fabricate it ... that determines transformer performance. Moloney's completely equipped laboratory constantly tests raw materials. Adherence to rigid specificati[illegible]ures the use of materials of the highe[illegible]uality. These factors plus a factory organizati[illegible]ith years of experience in exclusive tran[illegible]er manufacture are your guarantee of better profits through better transformer performa[illegible]

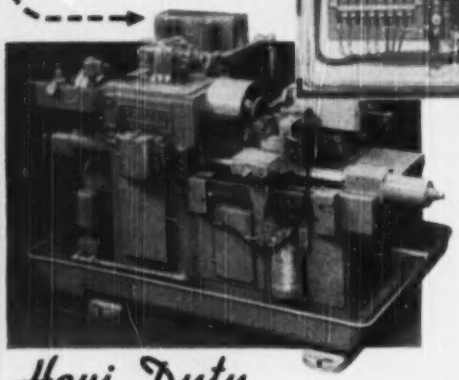
MOLONEY ELECTRIC COMPANY

TRANSFORMERS EXCLUSIVELY SINCE 1896

SAINT LOUIS 20, MISSOURI

When good regulation at low power factor loads with heavy inrush currents are required, Hevi Duty Control Circuit Transformers are first choice!





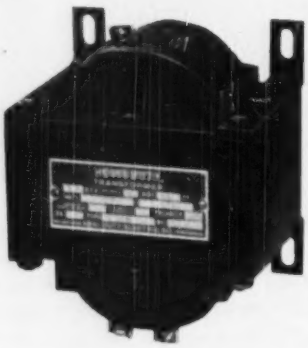
The GISHOLT No. 12 Hydraulic AUTOMATIC LATHE . . . designed for high production chucking work to meet new machine tool specifications for automatic use. Unusual requirements for lighting and contactor loads are met with Hevi Duty Transformers.

Hevi Duty

Control Circuit TRANSFORMERS

give you *better* regulation

Regulation curves quickly reveal the fact that you get extremely good regulation at low power factor when you use the properly designed Hevi Duty Control Circuit Transformer. In addition, you get rugged mechanical construction, oversize terminals permanently attached to coils during winding, and many other features that assure dependable performance. Regulation curves and complete engineering data are available. Write today.



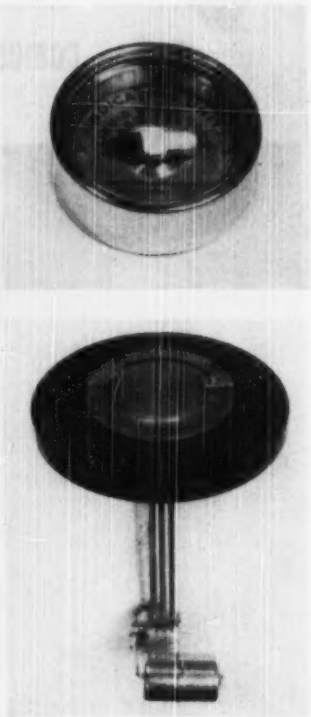
HEVI DUTY ELECTRIC COMPANY

HEAT TREATING FURNACES **HEVI-DUTY** ELECTRIC EXCLUSIVELY

DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS

MILWAUKEE 1, WISCONSIN

Magnetic Indicator Shows Oil Level in Transformer



LIQUID LEVEL indicator for submersible distribution transformers consists of pointer in portable, non-magnetic case (above) and float and magnet assembly. In operation, pointer case is placed on graduated disc to indicate level

V. A. VEIT
Assistant Engineer
Transmission and Distribution Bureau
Consolidated Edison Co of New York Inc
New York, N. Y.

By the installation of magnetic type indicators, level of insulating liquid in submersible type distribution transformers is readily determined. The device is applied to 500-kva oil-filled transformers. It could be used on other sizes of both oil and askarel-filled transformers with little or no change, depending upon the relative positions of the fluid levels and their distances below the cover of the transformer.

This indicator consists of two parts as shown in the illustrations. One part is welded to the transformer cover. It consists of a float, a pair of gears and a shaft to which a magnet

Stop Burned-down Jumper Loops!

O-B Strain Clamps permit construction of continuous jumpers that eliminate hazardous clamped connections

Bolted connectors in the jumper loops of high voltage transmission line strain points change with time. Once tight and conductive, they eventually relax due to strand collapse and bolt stretch. Corrosion and poor contact then lead to heating and burn-down. This is no hypothetical case. It is a reported experience the country over!

Eliminate this trouble in the simplest, surest way--eliminate the splice. This is done by stringing through all deadend points with a continuous conductor. O-B strain clamps make this possible. They also make possible an important list of economies, starting with the cost of the clamp itself, and including the elimination of all special field equipment for clamp attachment, rapid installation, and complete inspection of the cable attachment during construction or at any later time.

With a lower first cost from many angles, you gain the added advantage of unspliced jumper loops--with the elimination of their serious troubles--when you specify O-B strain clamps on your new transmission line construction.

Ohio Brass

MANSFIELD • OHIO

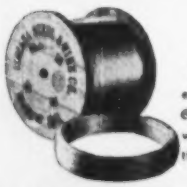
Combines All Four

EVERY requisite that sound construction needs demand are combined in *Crapo* Galvanized Steel Strand—

1. High strength
2. Ruggedness
3. Long life
4. Economy

The superior tensile strength inherent in steel is utilized to fullest advantage in each size and grade of this time-proved strand. The heavy, ductile, tightly-adherent galvanized coating—applied by the famous *Crapo* process—provides dependable protection to the steel, extends the life of the strand beyond the normal period of replacement.

Specify *Crapo* Galvanized Steel Strand for guys, messenger and overhead ground wires! There is a size and grade for every practical need available for prompt shipment.



ASK YOUR JOBBER!

Consult your nearest distributor of *Crapo* Products or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE INDIANA

is attached. This magnet is located directly below a non-magnetic metal disc that is brazed to a steel mounting collar. This part has a liquid level scale which is graduated for minimum, 25 C, 50 C and maximum levels.

The portable part or indicating unit is a magnetized pointer which is free to rotate under a glass cover of a non-magnetic metal case.

Level of the liquid in the transformer establishes the position of the float which determines the position of the magnet located below the non-magnetic disc. To make a liquid level check the indicating unit is placed on top of the non-magnetic disc. The magnetized pointer then will assume a definite position with respect to the magnet below the disc. The liquid level is determined by reading the level marking as indicated by the pointer. Rotation of the case that encloses the pointer will not change the position of the pointer.

This type of liquid level indicator eliminates the use of gaskets on transformers which are otherwise completely welded and thereby makes for improved operation of the transformers. It also eliminates the need of a separate liquid level indicating glass gage on the side or cover of each transformer.

Compressed Air Device Speeds Glove Inspection

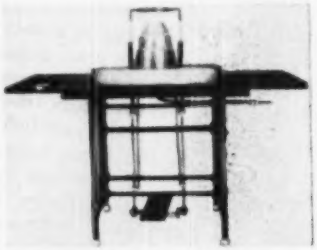
C. A. BIVENOUR, Meter Supt
E. A. GROVE, Meter Engineer
J. R. PADDEN, Safety Supervisor
The Ohio Power Co
Canton, Ohio

Compressed air is used to inflate linemen's rubber gloves for inspection of cuts, abrasions, and flaws in a device developed jointly by the authors. This method has several advantages:

1. Gloves may be inspected quickly on a large scale basis.
2. All parts of the glove may be completely and reliably inspected for small mechanical imperfections.
3. Twisting of the cuff for inflation of the palms and fingers, which subjects the glove to unnecessary strain, is eliminated.

This new device facilitates visual inspection. However, it is not designed to provide a complete test. Each glove is placed on the cone-shaped wood form having a connection through the center to admit compressed air. To hold the glove in proper position, a smooth metal ring is brought down on the cuff by pressing a pedal. Air is then admitted to inflate the glove fully but not expressively so that it may be visually examined while flexing it with the hand. A thumb-operated inlet valve is used to control the admission of air.

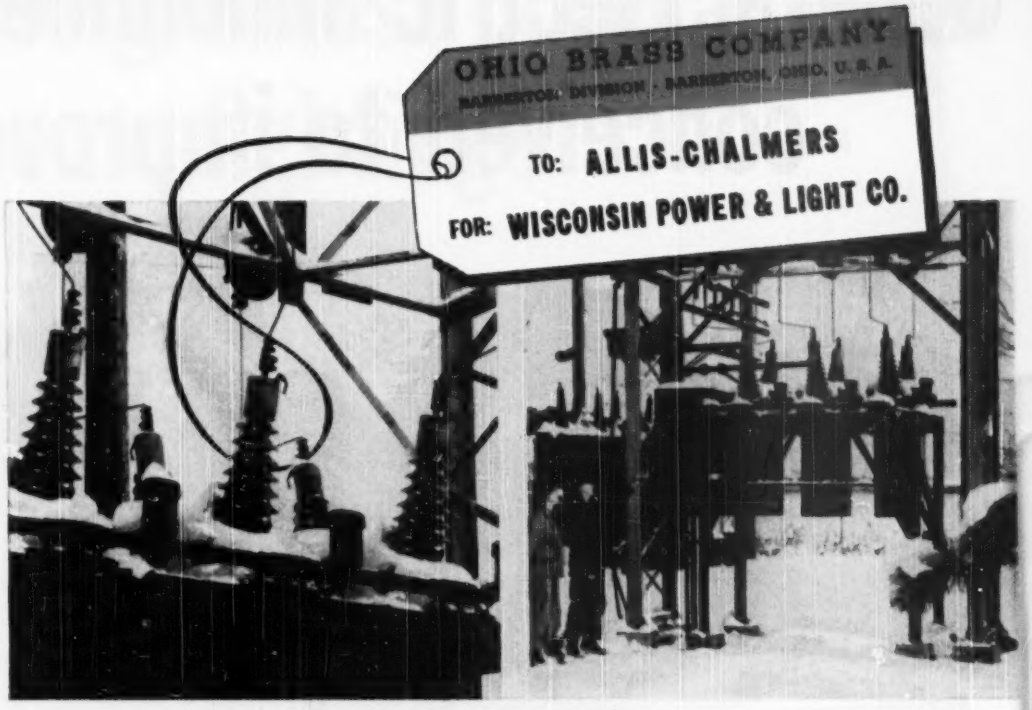
COMPRESSED AIR is run up through the cone on which the rubber glove is placed. Smooth iron ring is then depressed by foot pedal to clamp glove in position



GLOVE TESTER uses compressed air to inflate linemen's rubber gloves for rapid, large-scale testing. Device permits complete, reliable inspection for small mechanical flaws and eliminates twisting of cuff to inflate palm and fingers

To avoid stretching the glove unduly, the air pressure between the glove and air inlet valve is regulated so that it does not exceed 2 psi. This pressure has been found by test to be sufficient to inflate either new or used gloves to proper size. However the supply-line pressure is not reduced below 25 psi because this pressure is advantageous for inflating gloves to proper size quickly. The size of the inflated glove is sufficient to indicate when to stop admitting the air.

Because of the amount of experimentation involved in developing this piece of apparatus, its cost was about $128. However, a similar unit could probably be reproduced for $50. This cost may limit its used to places where large numbers of gloves are inspected.



UPHOLDING A TROUBLE-FREE RECORD . . .

After 10 Years of Heavy-Duty Breaker Operation

In the Stoughton substation of the Wisconsin Power and Light Company, these Allis-Chalmers Power Oil Circuit Breakers are still completely free from trouble after ten years of heavy duty service. As stated by A-C, "--they hold an unbroken record of 100% dependability in meeting the severe operating requirements imposed upon them from the time of their installation, June, 1940. Designed and built to supply vital electrical protection on power systems, oil circuit breakers like these will interrupt short circuits or normal load currents. With this kind of double-duty, the extra large design factor of safety built into every A-C circuit breaker pays dividends."

Both insulation and mechanical support of contacts depends upon the O-B bushings which were furnished by Allis-Chalmers as original equipment and, for over 10 years, both the breakers and O-B bushings have been free from all trouble. To insure the basic goodness of good apparatus, be guided by this performance and specify---

Ohio Brass

O-B BUSHINGS . . .
AN ESSENTIAL PART OF ANY OIL CIRCUIT BREAKER

MANSFIELD · OHIO

General Electric announces conceived to improve

CREATES A NEW CONCEPT IN LIVING . . .

THE "LIGHT-CONDITIONED" HOME!

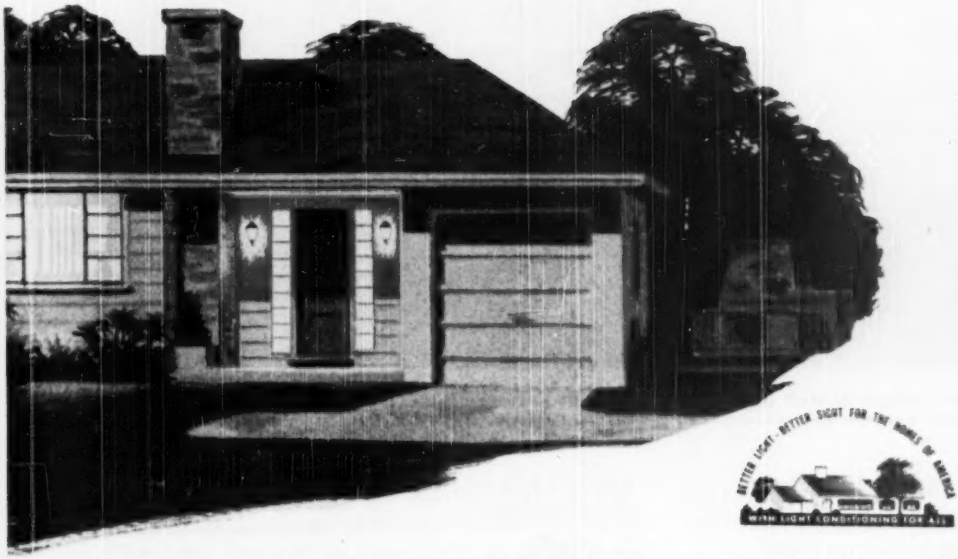
HERE'S the home lighting program that electric service companies, fixture makers, lighting dealers and contractors have been waiting for! It's General Electric's Home Light-Conditioning Program—aimed at raising the standards of lighting in both new homes and old!

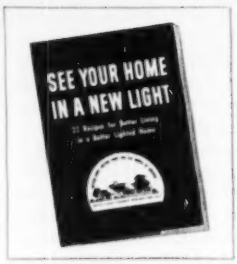
The Home Light-Conditioning Program is built around a set of authoritative, comprehensive lighting recipes—the first of their kind. These recipes, prepared by General Electric home lighting specialists and based on studies made by the Illuminating Engineering Society, cover virtually every lighting situation. They point the way to a *new kind* of home comfort and beauty—the "Light-Conditioned Home" that's as bright and inspiring as all outdoors.

Backed by General Electric's national advertising, plus local promotion by electric service companies, contractors, and dealers, the Light-Conditioning Program is now underway. One of the major aims of the program is to establish demonstration homes—a total of 10,000—where people can see how Light Conditioning will add new charm to their homes. For full information on how you can tie-in, write the General Electric Company, Div. 166-EW 12, Lamp Department, Nela Park, Cleveland 12, Ohio.

LAMPS

the greatest program ever home lighting!





Prepared by General Electric for broad distribution, the "Light-Conditioning Recipes" book gives detailed information for lighting every room. Available at cost.

General Electric's national magazine, radio, and television advertising backs up the Light-Conditioning Program. Ads will appear in Saturday Evening Post, Ladies Home Journal, Better Homes & Gardens.

To help promote the program in your own territory, General Electric offers a set of advertising mats for use in local newspapers.

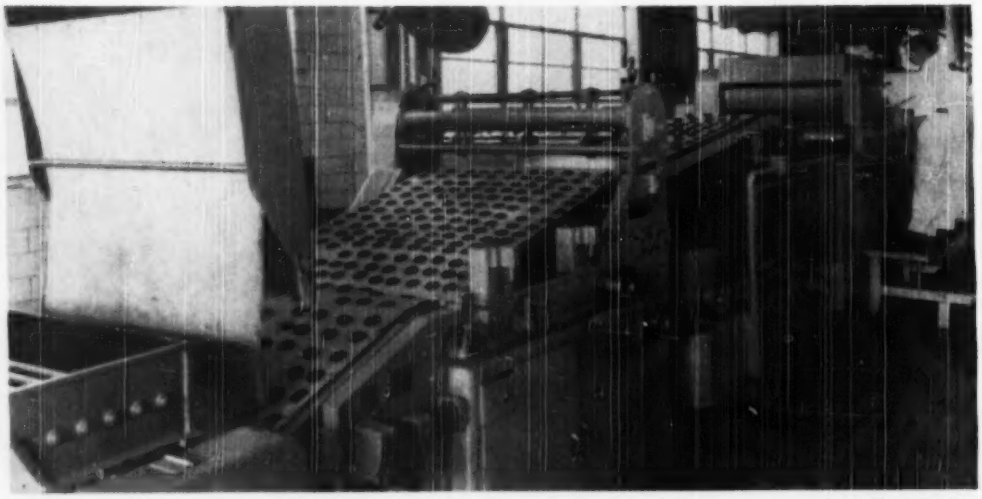
Reprints are available of a feature article on Light Conditioning from the November issue of Better Homes and Gardens.

GENERAL ELECTRIC

LOAD BUILDING

INDUSTRIAL • COMMERCIAL
RESIDENTIAL • RURAL

Coordinated Drives Increase Production In Modern Bakery



General Electric Co photo

CONTINUOUS PROCESS BAKING operations uses electrical coordinated drive to provide more uniform product and increase production. Baker can easily manipulate large high production machine and develop more readily marketable baked products

Product variations due to human error in the making of baked biscuit products have been practically eliminated through the electrical coordination of driven equipment at the Farm Crest Bakeries' new cookie plant at Columbus, Ohio. This new, ultra-modern bakery uses the coordinated drive as part of their continuous process baking operations.

The adjustable speed coordinated drive enables the baker to manipulate easily a very large high production machine. He can experiment and develop new and more readily marketable baked products and still retain a higher production than can be obtained with the use of less easily managed, singly controlled units.

The drive is assembled from a number of standard components which do not require extensive engineering analysis for each new job. This is one of the chief factors in the drive's flexibility.

Cleanliness, an important item in

food plants, is one of the predominant qualities achieved in the use of this electric drive, as the major equipment necessary for effecting a speed adjustment is remote from the machine.

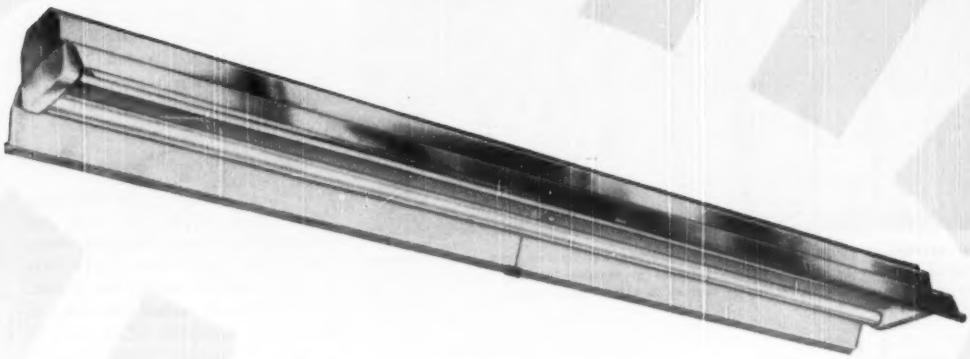
To change from one type of baking product to another, it is usually necessary to change the relative speeds of some of the drives. The speed of the dough-forming and extruding drives must be coordinated with the speed of the 200-ft continuous steel band oven, cooling conveyor, stacker, packing table, etc. The speed of the over-all machine must also be adjusted.

This complex change-over is accomplished with a minimum of effort through the use of the coordinated drive. The operator can vary the baking time from 3½ to 14-min by operating a push button station. This controls a motor-operated rheostat in the master panel, which in turn controls over-all bake time and the speed of the various drives in the same proportion. The oven speed range is 4 to 1 and to cover the range of adjustments needed, some of the drives have a 20 to 1 speed range.

Fig bar production is a good example to demonstrate the coordinating ability of this control. The filled dough jacket is extruded at the entry end of the oven in a number of long, parallel forms and moves continuously through the 200 ft oven. After the strips leave the oven, they are cut into bars of correct length by the fig bar cutter which is driven by a coordinated drive, the speed of which can be adjusted to set the desired length of the fig bar. The cutter automatically adjusts its speed to maintain the same bar length even when the baker changes oven speed.

Modern as tomorrow!

New Wheeler RLM "Industri-Line" Slimline Fixtures



An outstanding, progressive step in Industrial Lighting! Wheeler Engineers have built into these newly-designed line of units 6 Better-Value Features. For greater value, greater efficiency, insist on Wheeler R.L.M. Slimline Fixtures!

★ **High Output:** gives more light per foot of lamp length.

★ **Latest G. E. Turret Type Lampholders (depressable):** for single pin contact, making lamp insertion and removal easy.

★ **Reflectors in Sections:** for greater ease in handling, each unit furnished with two open-end or closed-end porcelain enamel reflectors.

★ **Individual or Continuous Mounting:** extremely simple mounting operation.

★ **One-piece Top Channels:** made of heavy gauge steel. Finished in either porcelain enamel (recommended where excessive moisture conditions exist) or baked synthetic enamel.

★ **Designed for use with two and three T-12 Slimline Single-Pin Lamps:** Instant starting.

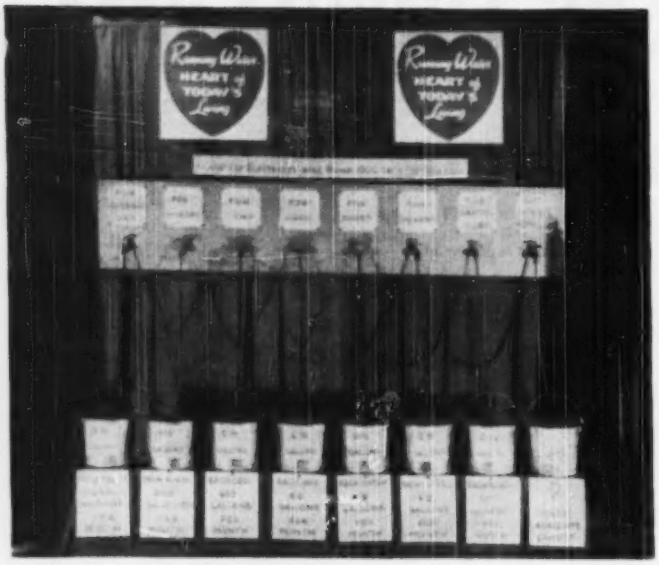
Get complete details from Wheeler Reflector Company, 275 Congress Street, Boston 10, Massachusetts.

Wheeler **REFLECTORS**

Distributed Exclusively Through Electrical Wholesalers

MADE BY SPECIALISTS IN "SKILLED LIGHTING" EQUIPMENT SINCE 1881

Rural Load Building Campaign Emphasizes Water Systems



SHOW WINDOW DISPLAY in power company's building during rural campaign illustrated benefits of electric water systems in manner farmer could appreciate. Adjoining window had electric water system in actual operation

L. L. KOONTZ
System Rural Supervisor
Appalachian Electric Power Co
Roanoke, Va.

The "Going Places" Campaign, covering the period May 15 through September 15, 1950, resulted in the sale by local dealers of 6,363 electric water systems, 6,898 electric water heaters and 18,031 electric ranges on the lines of the Appalachian Electric Power Co and Kingsport Utilities, Inc —an estimated increase in recurring annual revenue of approximately $750,000. Installed on rural lines were 48.8% of the electric ranges, 46% of the electric water heaters and 94.6% of the electric water systems—a bang-up job of rural load building during the 4-month period.

The spring of 1950 found Appalachian's rural organization in the transition period from rural line building to rural load building. To accelerate and to bring the rural load building possibilities more clearly and properly into focus, a wide awake sales promotion campaign, "Going Places," was launched. The campaign was set up on a "points credit" basis to cover electric water systems, water heaters and ranges. Quotas were established on company, division, district and individual basis. The campaign "caught fire" from the very beginning, finally resulting in attaining 396% of water system quota, 172% of range quota, and 110% of water heater quota.

Electric Water System the Keystone

Realizing that the electric water system is the key to complete electrification of the farm and home, it was given special emphasis during the campaign. This promotion involved 105,000 special direct-by-mail pieces by Appalachian, plus thousands of direct-by-mail pieces direct from the various local dealers in cooperation with their manufacturers.

Appalachian also used 18,000 pieces of the National Electric Water Systems Council folders entitled "The Case of the Missing Heart," 300 sets of the Council Window Trims, 65 Myers Animated Displays, and 12 Capex backgrounds in addition to those developed at the local level.

All agencies interested in the betterment of the farmers's situation were encouraged to join forces in focusing attention on the importance of running water under pressure to the farm and rural family and what it would do for them. County farm and home agents, vocational agricultural instructors, county health departments, state extension services, and others were most helpful.

Local newspapers carried local success stories with pictures and radio stations carried programs and spot announcements. It was the subject for discussion at club meetings, group meetings, and numerous demonstrations. Manufacturers and distributors sent demonstration trailers into the area. Local dealers advertised in papers, put displays in windows, held demonstrations, called on prospects.

Promotional Schemes

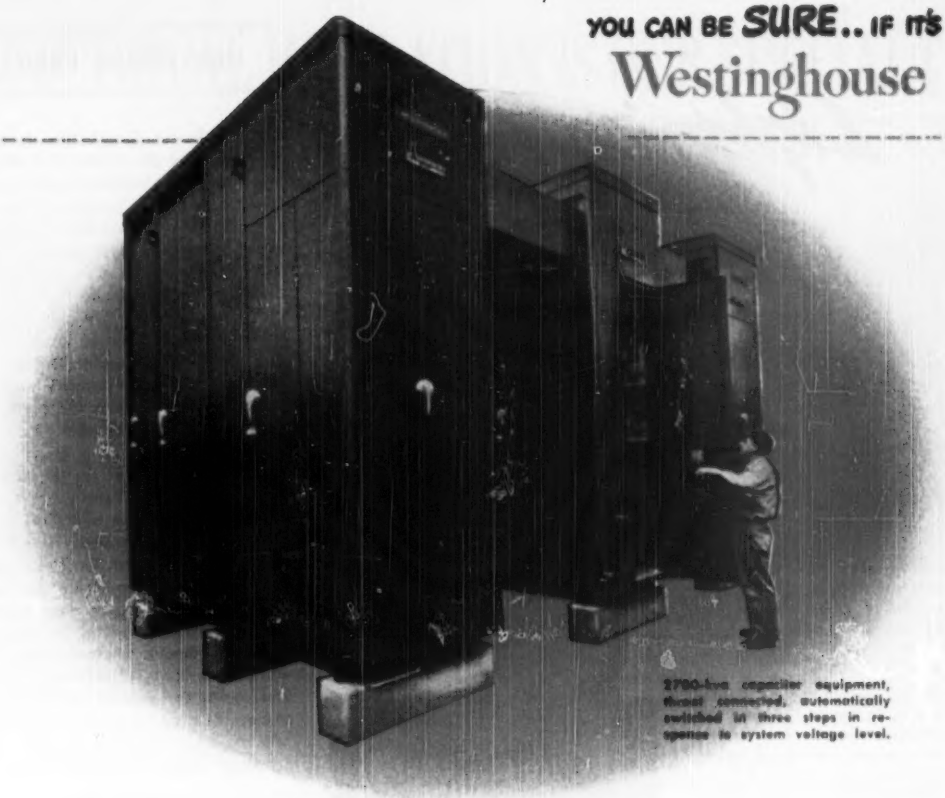
In the promotion of all three campaign items, all the old tried and proven promotional mediums were used in addition to several new local versions such as having an electric water system in actual operation in the power company office window pumping the average monthly requirements for a farm family and having a guessing contest as to operating cost, etc. The rural area representative carried a small system in the trunk of his car giving the prospective buyer an actual demonstration by dropping a hose in the spring or well. Electric cooking schools, demonstrations, and movies all did their part in playing up advantages to be gained.

Perhaps the most important of all was the enthusiastic participation of company personnel, educational agencies and groups, manufacturers and distributors, plus some real action on the part of the local dealers—all of which added up to results. In the case of the top district—one out of every 10 residential customers purchased either a range or water heater during the 4-month activity. In addition, they purchased 516 electric water systems.

The top rural area sales representatives in each of the company's 14 districts, plus others from the top 3 districts and the top division, enjoyed a two-day deep sea fishing trip off the Carolina coast as a reward for their outstanding achievements.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



2700-kva capacitor equipment, thrust connected, automatically switched in three steps in response to system voltage level.

WESTINGHOUSE HOUSED CAPACITOR UNITS

Keep Voltage—AND COSTS—in line!

You can be *sure* of dependable voltage control with Westinghouse Housed Capacitor equipment. You can be *sure* about savings too, because the Westinghouse unit is designed to trim your substation costs. For example . . .

A compact design allows for smaller substation space . . . lower real estate costs.

Factory assembly assures low installation costs. You need only mount the housing on pads, set capacitor units in place, and make primary connections.

Complete interlocking assures safety to personnel—shorting and grounding the capacitors before housing can be entered.

A self-contained design saves the cost of installing external accessories.

Savings like these are supplemented by extra revenue when good voltage control is maintained at the substation. And Westinghouse housed equipment with built-in automatic control—responsive to line voltage, load current or kva load—assures the finest.

For complete information on Westinghouse Inerteen Capacitors, write for Booklet B-4343. Address: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60723

Westinghouse

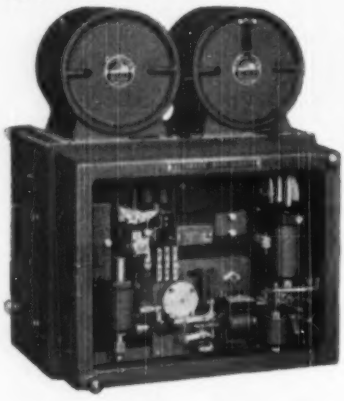
CAPACITORS

Lightning-Fast Records..

..with this G-E Automatic Oscillograph type PM-13

In one quarter cycle this automatic instrument goes into action. It provides you with detailed, graphic records of how your power system behaves under all fault conditions. This information can help you—

1. Reduce loss of service. Faults are more quickly located for repair
2. Save money on special patrol expense
3. Detect minor faults before they cause major damage
4. Determine causes of system instability
5. Supervise relay and breaker operation.



THE PM-13 IS FULLY AUTOMATIC. No operator is needed. It starts (in 1/240 second), records entire disturbance, and stops after fault has been cleared. Operation can be initiated by any device that will break a circuit, so it is suitable for use at an unattended station. It will make 100 oscillograms without attention.

CLEAR, WELL-SPACED RECORD. A special arrangement prevents crowding at the start, and the lamp burns more brightly at that time to assure a clear starting record. The trace paper is 4¼ inches wide. This permits ample separation of traces yet avoids the high cost of wider paper.

DEPENDABLE OPERATION. This oscillograph operates from its own power source (automatically kept at full voltage). During the standby period the only part energized is the light source—no moving parts to wear out or require attention. No special skills are required to care for it.

MORE ADVANTAGES—Built-in alarm contacts, adjustable recording time (two to twenty seconds), and time-stamp identification (date, hour, and minute of record) are just some of the other reasons why you'll appreciate every PM-13 in your system. You can order now from your nearest G-E representative. Or, if you want more information, write for Bulletin GEC-396. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

INDUSTRIAL BRIEFS

Difficult Power Distribution Problem was solved at the 14-story Cincinnati Enquirer Office Building by the installation of a bus duct system. Busway system permitted traveling a circuitous route between existing electrical conduits, steam lines, air conditioning ducts and building beams. While the feeder required for the new service from circuit breaker to switchboard was only 60 ft long, the thought of installing 2,000-amp capacity multiple cables in conduits with the necessary pullboxes was eliminated.

Hog Fuel Milling at the Hammond Furniture Co Ltd, Vancouver, B. C., using a hammer-type mill has solved the waste products problem by ridding the plant and adjacent hardwood sawmill of waste wood products. Nails or small metal pieces will pass through without damage. Mill is driven through a flexible chain coupling by 40-hp motor. A 7½-hp motor drives a worm screw and bucket conveyor to carry hog fuel to top of storage bin. Mill produces 15 units of fuel and consumes approx 200 kwhr daily.

Portable Aggregate and Batch Plant, operated by the Western Contracting Corp, Newman, Cal., is completely powered by electric motors. Plant has a capacity of 245 tons of specification aggregate per hour and can be disassembled and moved to new job locations. Motors used to drive the conveyor belts at various stages of process are 7½ hp. Rock crusher has 150-hp motor. Deep well pump supplying plant with water has 75-hp vertical motor. Motors are interlocked by a control system.

Steel Beam Fabrication, at the Crescent Iron Works, Philadelphia, Pa., is speeded by the installation of an electric rivet heater. Operating on 220 w with a 125-amp demand, the two electrodes produce up to 345 rivets of ⅜ in. or 1 in. diam per hr.

Heater eliminates smoke, gases and intense heat which resulted when a hand operated coke furnace was formerly used. With the electric rivet heater there is no preheat required, thus saving manhours.—L. Albertson, application engineer, Philadelphia Electric Co.

ELECTRICAL INSULATION IS OUR SPECIALTY

Q. *What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?*

A. UNITED STATES RUBBER COMPANY.

Q. *What ONE wire and cable producer makes plastics?*

A. "U. S."

Q. *What is the most important part of wire and cable?*

A. The insulation.

Q. *Who is best equipped to make wire and cable with superior insulation?*

A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.

Tapping rubber from one of the millions of trees on U. S. Rubber's giant plantations in Malaya.

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U. S. Rubber has been a pioneer in insulation for over 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U. S." specialty!

Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U. S. Rubber.

SOME MORE OF THE MANY DIFFERENT VARIETIES OF "U. S." WIRE AND CABLE

UTILITIES: Power Cables • Street Lighting • Royal Cords • Network Cables • Utility Control • Pole & Bracket Cable • Service Entrance • Weatherproof • Zip Cord Pole Fixture Cable • Sup. Control

RAILROADS: Power Cables • Communications • Railway Signal • Royal Cords • Welding Cable • Railway Utility • Sup. Control • Weatherproof

HEAVY INDUSTRY: Power Cable • Royal Cords • Welding Cables • Control Cables • Machine Tool Wire • Building Wire • Switchboard Wire • Thermostat Cable • Bus Drop Cable

Absolute Tops in OZONE MOISTURE HEAT Resistance

U. S. RUBBER'S BUTYL-INSULATED POWER CABLES

These cables are for use on power distribution, street lighting and station control circuits and for general-purpose wiring on circuits up to 8000 volts between phases and at conductor temperatures up to 80 C. The insulation will not crack after four hours in air containing 0.015 per cent ozone. They are light in weight, easy to install and join, and are resistant to oil, heat, sunlight, flame, acids, alkalies and corrosive chemicals. The following are guaranteed test values:

PHYSICAL AND AGING PROPERTIES (MINIMUM VALUES)

	Butyl Insulation			Neoprene Jacket	
	Unaged	After 168 Hrs. in O.B. at 80 C.	After 7 Days in Air Oven at 250 F.	Unaged	After 96 Hrs. in O.B. at 70 C.
Tensile, lbs. per sq. in.	600	500	400	1800	1600
Elongation, per cent	400	350	350	300	250

MOISTURE RESISTANCE (MAXIMUM VALUES)

a. Dielectric constant and power factor of insulation after immersion in water at 50 C.

Dielectric constant, one day	4.0
Per cent gain, 1 to 14 days	2.0
Per cent gain, 7 to 14 days	1.0
Power factor, one day, per cent	2.0

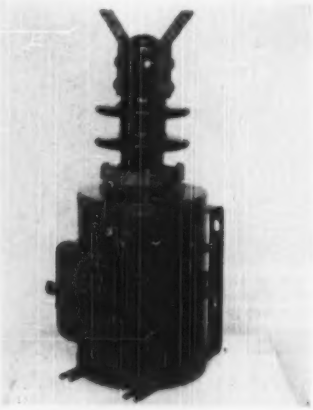
b. Mgs. per sq. in., 7 days at 70 C. 15.0

U.S.RUBBER SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPT. • ROCKEFELLER CENTER, NEW YORK 20, N.Y.

NEW EQUIPMENT



Current Transformer

Horizontal, vertical, or inverted mounting is possible with Type KO outdoor current transformer. The completely welded case is pressure tested and hermetically sealed.

Both primary leads are brought out to blade-type terminals through a single porcelain bushing having generous creep surface. Maximum insulation strength is achieved by compound filling under a "vacuum-pressure" process said to eliminate air voids and to result in low power factor. Standard ratings are available up to 800 amp and through voltage classes 5, 8.7, and 15 kv.

Allis Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

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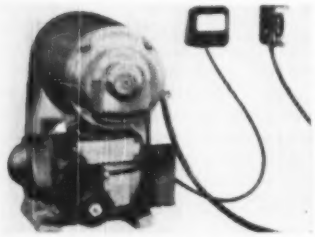

Remote Control Drives

Package-unit electric remote control has been announced for the company's variable speed power drives. The unit includes a mounting bracket, reversing motor, chain and sprockets, friction clutch, chain guard, and remote fast-slow station. Remote speed indicators are available.

Ratings of ½ to 25 hp are being manufactured with 2:1, 3:1, or 4:1 speed variation in a range of speeds from 2,000 rpm down to 26 rpm.

Sterling Electric Motors, Inc, Telegraph Rd at Atlantic Blvd, Los Angeles 22, Cal.

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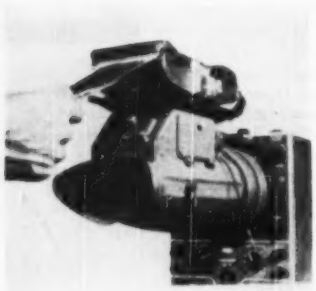


Oscillograph Camera

In one minute a new oscillograph-record camera is claimed to give a complete record of an oscillograph image—no darkroom facilities required. The camera is designed for application with any standard 5-in. cathode-ray oscillograph.

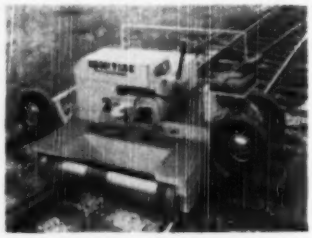
By means of a sliding mount the camera may be positioned so that several traces can be recorded on a single print, for side-by-side comparison. Lens aperture is f/2.8 and lens is coated to minimize halation. Shutter settings are 1/100, 1/50, 1/25, time, and bulb. Size of print is 2¼x3¼ in., with a ratio of dimensions from trace to recording of 2.25:1.

Allen B. DuMont Laboratories, Inc, 1000 Main Ave, Clifton, N. J.

•

Railway Car Handler

Coal and other railway cars can be hauled, spotted, and switched with the Trackmobile. It couples to any standard railway car such that a portion of the car's weight is transferred to the Trackmobile, enabling it to develop a maximum draw-bar pull of 7,350 lb. Hydraulic jacking power is employed to gain this pulling power.



The gasoline-powered car handler can travel either on railway track or on the ground; it takes 30 seconds to change from one mode of travel to the other. Four standard AAR steel wheels are for track travel. Four rubber-tired wheels for ground travel are hydraulically retracted when positioned for track operation.

The car handler can move from track to ground, travelling across the yard for another job at a maximum speed of 25 mph, rather than following the tracks. Bulletin TM-101 contains a further description of the machine, which will be on the market early in 1951.

Whiting Corp, Harvey, Ill.

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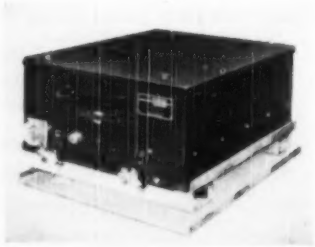
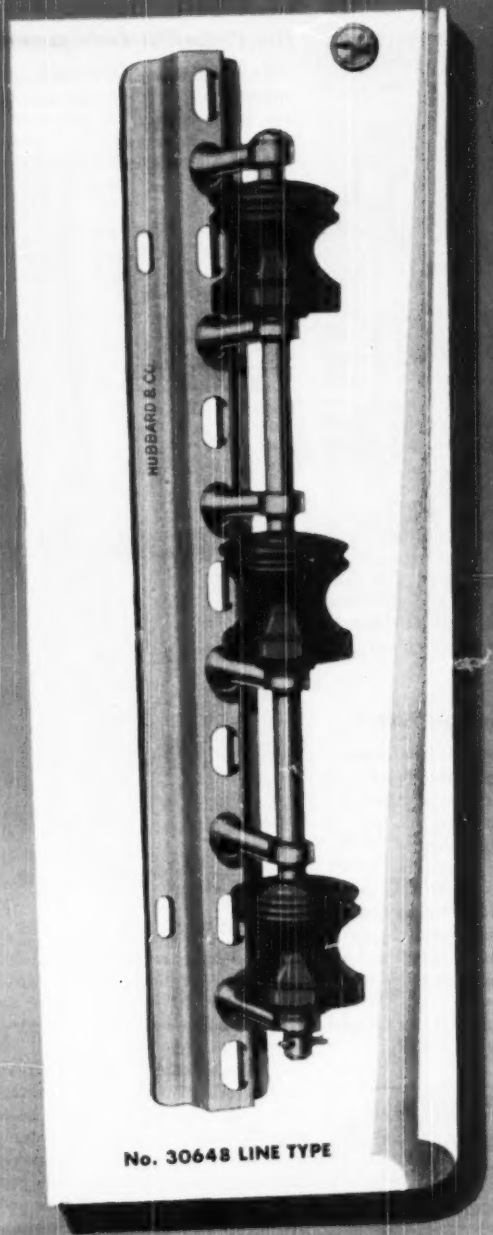


Mobile Radio Equipment

Design of the MRT-5B two-way mobile radio unit is reported to make it suitable for installation on machines and vehicles where heavy shocks and vibration will be encountered. Suggested uses include



No. 30648 LINE TYPE

HUB-RAK

THE PRIMARY RACK FOR SECONDARY SERVICES

Not Galvanized

There are many good reasons why the Hub-Rak has enjoyed top popularity in the years since its introduction. It has been designed for easy mounting and long-life economy, in a range of sizes for every application. Note these features:

1. Forged steel points rigidly attached through the back to form a single unit . . . points smoothly rounded on all exposed surfaces.
2. Heavy back pressed to channel shape for added strength . . . designed to allow back-to-back mounting on poles.
3. Points perfectly aligned . . . rack bolts easily inserted . . . insulators easily replaced.
4. Mounting slots conveniently located to allow insertion of mounting bolts back of insulators at points of greatest strain, or wherever desired.
5. Line and Service Types with extended backs; Line Type also with non-extended back.
6. Finest grade porcelain insulators, designed for protection to conductor while "pulling in" the lines.
7. A rugged unit of heavy steel . . . the finest rack ever produced.

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

construction equipment, cranes, and heavy trucks.

A 10-12-w FM transmitter receiver and power supply are designed for adjacent channel operation in either of two channels in the 152-162 mc band. Shockmount is provided.

Bendix Radio Div, Bendix Aviation Corp, Baltimore 4, Md.

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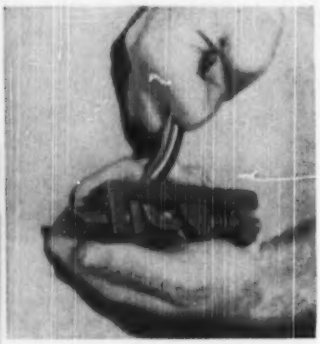

Grating Lock

A new lock that can be used for sidewalk gratings protecting utility vaults becomes an integral part of the grating after being installed either in the field or by the grating manufacturer. In addition to unlocking, the key serves as a handle which facilitates opening and closing. It is claimed to be practically "pick-proof."

Safety features are said to include:

1. Personnel cannot be trapped by grating falling shut since the lock can be unlatched from the underside without a key.

2. There are no projecting parts to hinder access by working personnel.

3. Key forms an operating handle to keep hands and fingers in the clear.

4. Grate openings are held to a minimum.

5. Improper closing is indicated visually.

The lock is comprised of five main parts: Main frame, sliding bolt, guide bolt, spring, and shakeproof washer.

Castle Lock Co, 4104 Maryland Drive, Washington 16, D. C.

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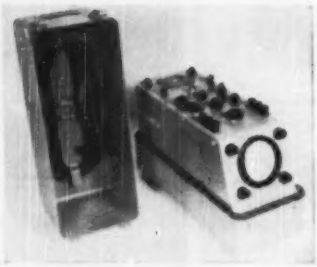
Miniaturized Oscilloscope

Features of laboratory-type equipment are said to be incorporated in a portable miniaturized oscilloscope



especially intended for testing high-frequency equipment. Sweep frequency range is from 3 to beyond 50,000 cps. Reproduction is reported for wave forms with 3-microsecond rise times, and 100-kc square waves.

Other manufacturer's information includes: Vertical amplifier response is flat within 3 db from direct current to 2 mc, while horizontal response is flat within 2 db from direct current to 100 kc. Circuit design maintains a sweep return time ratio not less than 5 to 1 at all frequencies.

Hycon Mfg Co, 2961 E. Colorado St, Pasadena 8, Cal.

•

Overheat Control Switch

A manual reset overheat control switch, providing protection against temperatures in excess of those for which the equipment is set, can be supplied integrally mounted to the spdt water heater thermostat. It can also be supplied as a separate switch for equipment already in service.

Cut-out temperature may be set at any level from 160 to 200 F in steps of 5 deg F; rating is 6,000 w resistance load at 240 v ac.

Cam Stat, Inc, 2310 S. La Cienega Blvd, Los Angeles 34, Calif.

MORE NEW EQUIPMENT

Just Received

Appearing Next Issue

COMBUSTION PROCESS CONTROL
Electronic system for use in combustion and process control

OIL SWITCHES
Carry 400 amp in voltage ratings from 600 through 23,000 v

SWITCHBOARD INSTRUMENTS
Dial-cover concept gives maximum readability at steep angles

MULTIPLE UNIT SIGNAL
Will notify of off-normal operation of almost any equipment

Dry Chemical Extinguisher

Tank of the Alfco 350 extinguisher, containing 350 lb of dry chemical, can be discharged if necessary in about one minute and fifteen seconds. It is intended for extinguishing flammable liquid and electrical type industrial fires.

Density of dispersion of the discharge has the effect of cooling and insulating the operator. Discharge range is 20-25 ft. The expellent is dry nitrogen with a sustained operating pressure of 200 psi during the discharge period.

American-LaFrance-Foamite Corp, Elmira, N. Y.

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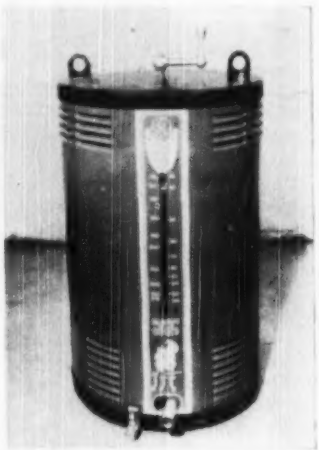


AC Welder

A portable ac welder, equipped with automatic Hot Start control, known as the 6WK30J series, is one of the first standard welder lines incorporating silicone insulation.

Correct amount of boost is reportedly furnished for any specific current setting. Automatic reduction of boost at higher current settings avoids drawing current surges from the power line. A primary switch to interrupt both sides of the line is of double-pole construction, and provides a convenient means of turning the welder on and off. There is no four-hour operation limit to avoid overheating the welder.

Coils of the welder are impregnated with Class H insulation. Windings have been rated at 130 deg C temperature rise to provide long life. Weight is 325 lb; current range is 40

YOU CAN BE **SURE**.. IF IT'S
Westinghouse

USEFUL LIFE OF WEMCO C TRANSFORMER OIL INCREASED THREE TIMES

Inhibitor Added

Greater freedom from oil maintenance problems! Development of a new inhibiting agent, and its addition to WEMCO C Transformer Oil, has resulted in greatly increased service life.

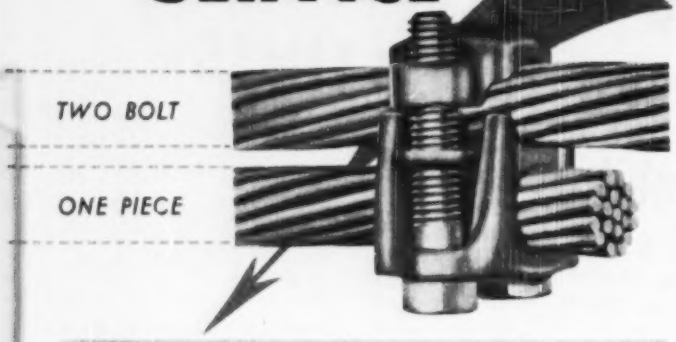
All the advantages of standard WEMCO C are maintained: low viscosity . . . freedom from acids, alkali, and corrosive sulphur . . . resistance to emulsification . . . freedom from sludging for long (now even longer) periods of service. *Inhibited WEMCO C* now maintains all these properties *three times longer!*

Now supplied as standard in all Westinghouse Distribution Transformers (both "CSP"® and conventional), *Inhibited WEMCO C* will shortly be standard in Westinghouse Power Transformers and will also be available for replacement use. For further information, contact your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-70575

Westinghouse
DISTRIBUTION TRANSFORMERS

ENGINEERED
FOR
UNINTERRUPTED
POWER
SERVICE



TYPES "K" AND "KR" CONNECTORS ARE • •

DESIGNED: With each component of a special alloy for high strength and to achieve a specific electrical and mechanical function.

DESIGNED: With flexing arch type clamping members to retain high pressure contacts on conductors during vibration and temperature changes.

DESIGNED: To transmit high pressure contacts from connector clamping members through each conductor strand to core wire.

DESIGNED: To limit high resistance oxide formations on connector contact and conductor interstrand contact surfaces.

DESIGNED: To eliminate connector failures resulting from heavy short circuit current surges passing through oxide contamination on connector and conductor interstrand contact surfaces.

DESIGNED: To withstand Mercurous Nitrate Specification ABW-124-1* which insures against seasonal and stress corrosion cracking failures.

DESIGNED: In two styles, "KR" with conductor spacing bar, "K" without. Both "K" and "KR" series include 7 sizes for conductors from #8 to 1000 MCM.

*Identical to ASTM B-154-45 Mercurous Nitrate Specification except ABW-124-1 specifies stressed components which is a more severe test.

Consult one of our nearest 19 representatives or contact our main office.

Write today for Bulletin K-175 on "K" and "KR" Distribution Connectors.

ABW

ANDERSON BRASS WORKS, Inc.
POST OFFICE DRAWER 2151
BIRMINGHAM, 1, ALABAMA

BRONZE AND ALUMINUM POWER CONNECTORS, FITTINGS AND BUS SUPPORTS
ALUMINUM WATERPROOF AND STRAIN CLAMPS

to 375 amp. Electrodes from 3/32 to ¼-in. diam are accommodated.

General Electric Co Apparatus Dept, Schenectady 5, N. Y.

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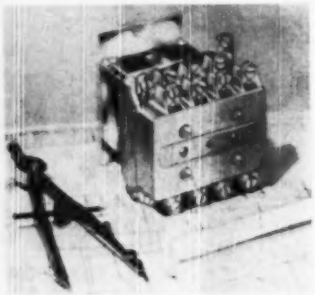

Convertible Contactor

Instant circuit conversion without additional parts, by means of reversible contacts, is provided by the Type CRA contactor. The 2¾-in.-sq unit has only four basic parts: (1) Frame containing magnet coil, and the right-angle mechanism; (2) movable contact unit; (3) stationary contact base; and (4) mat-finished contact cover plate.

Two to eight-pole types are being produced for requirements of 6 to 600 v ac, and 6 to 230 v dc. Complete information about these Size 00 contactors appears in Data Folder G-7006.

The Arrow-Hart & Hegeman Electric Co, 103 Hawthorn St, Hartford 6, Conn.

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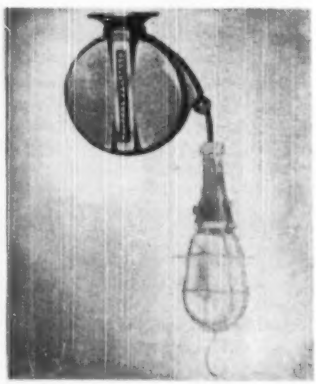

Take-Up Reel and Swivel

Up to 25 ft of extension cord can be paid out and automatically retracted by the 7S Series Reelite. It can be used with cord for lighting (or

portable tool power supply) on loading platforms, in garages, in stockrooms, and for machine inspection or maintenance work.

Continuous swivel action permits hand-lamps or other devices to be used anywhere in a 50-ft circle without cord tangling or current interruption. It is rated at 10 amp, 250 v, and is installed on a 4-in. octagonal outlet box.

Available accessories include six types of handlamps, a machine tool connector body, and a key socket.

Appleton Electric Co, 1701-59 Wellington Ave, Chicago 13, Ill.

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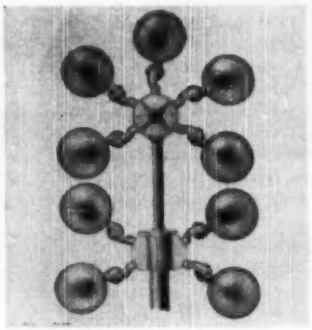


Cluster Lights

Called Red Cappers, a new line of Cluster-Lites can be used in numerous combinations to custom-build lighting to fill a wide variety of requirements. The line is said to offer for the first time vertical and horizontal aiming quadrants for Cluster-Lite lamp holders, allowing the light to be aimed accurately at any angle.

Basic units are the medium and mogul base lamp holders, a slip-fitter cluster box, and a cluster box. With openings on either end of the slip-fitter cluster box, it can be mounted on a 1½ or 2-in. pipe. Top unit on pole in illustration is a cluster box with five lamp holders. Immediately below is a slip-fitter cluster box holding four lamp holders.

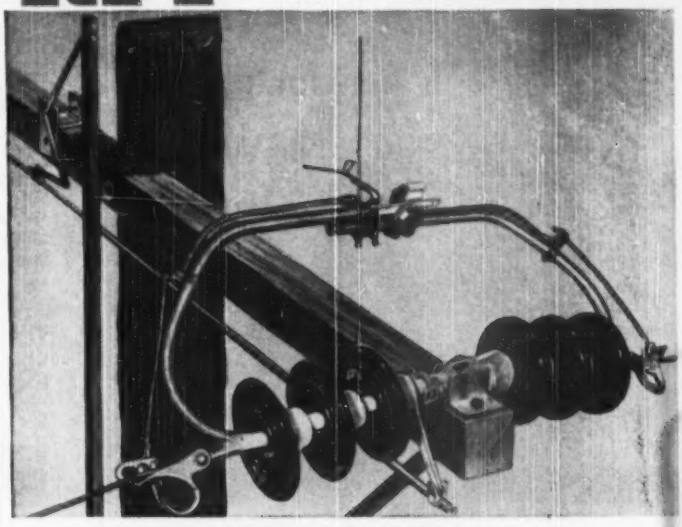
S. & M. Lamp Co, Terminal Annex Box 2315, Los Angeles 54, Cal.

•

Transformer Welder

Three current ranges of new 200-amp MCX welder provide from 30 to 250 amp. This permits use of 1/16 to 3/16-in. diam electrodes. Silicone insulation offers high-temperature and

KPF POLE TOP SWITCHES



Simple design means more switch ...for less money!

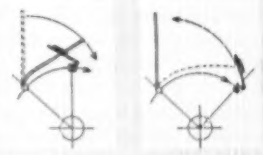
KPF Pole Top Switches cost less because they are simplest in design. They lower installation costs because they bolt on a single crossarm in minutes, require no extra insulators. KPF switches save, too, on upkeep; simple push-pull interphase rods never bind because of crossarm warpage; monel and bronze bearings never need lubrication.

KPF switches may be used in horizontal, vertical or triangular mounting. Free floating, self aligning blades and jaws maintain proper contact under all conditions of switch sag adjustment.

NEW QUICK-BREAK ATTACHMENT FOR KPF SWITCHES

The split-second breaking speed of these new KPF attachments means you can switch many circuits without using expensive circuit breakers. Attachment is available for all KPF switches rated 15 to 69 kv.

WRITE FOR DETAILS



Spring rod winds to full tension as switch opens.

Rod springs clear, breaking contact at high speed.

KPF ELECTRIC COMPANY
855 Howard Street • San Francisco 3, Calif.

LOOK here for answers to Tomorrow's NEW Problems

Now that priorities, allocations, cut-backs, and other essential restrictions have returned to the industrial scene, the heating, ventilating, and air-conditioning picture is certain to undergo significant changes in the days to come—to pose new problems for utility commercial departments and power sales engineers. That is why attendance at this foremost Exposition of its kind—largest ever staged—takes on greater importance and timeliness than ever. The wealth of first-hand information available here on latest developments, newest trends, available equipment and supplies, and sources of supply, may prove to be an invaluable business asset for the uncertain times ahead.

Over 300 exhibitors with their technical representatives will be on hand to show and tell what the future offers for heating, ventilating and air conditioning in all types of commercial and public buildings, industrial plants, and homes. In no other way can so many helpful ideas and valuable contacts be obtained, and so much equipment seen and compared in so little time . . . all so essential to solving tomorrow's new problems.

So plan now to take advantages of this big opportunity. Note the dates.

Auspices of the American Society of Heating & Ventilating Engineers

Management International Exposition Company

water-repellant features.

Welder employs an automatic hot start control with a hermetically sealed gas-filled, time-delay relay magnetic switch that has no open contact.

Air Reduction Co, 60 E. 42nd St, New York 17, N. Y.

MORE NEW PRODUCTS about which you should know

Valley Forge Safe-Eye Alarm Service, Lansdale R.R. 1, Pa., has developed an electronic **smoke alarm system** that sets off an alarm at first spiral of smoke, and indicates fire location on a relay panel. . . . Edison Electrical Co, 355 Weybosset St, Providence 3, R. I., is making a combination **safety guard** and guide which is said to prevent fluorescent lamps from falling. Called the Lok-Gyde, it is reported to reduce by 80% the time for installing lamp guards.

Photovolt Corp, 95 Madison Ave, New York 16, N. Y., has developed a line-operated electronic multiplier **photometer** for measurement of extremely low light values, down to 0.0001 microlumen; description in Bulletin 360. . . . Richmond Glove Corp, Richmond, Ind., offers an all-purpose **work glove** for handling heavy materials.

The Hart Mfg Co, 110 Bartholomew Ave, Hartford, Conn., has a new dpst **toggle switch**, Model 2160A, for panels ranging from 0.025 to 0.100 in. It is rated 15 and 20 amp, 125 v; 10 amp, 250 v ac, and up to ¾ hp at 250 v ac. . . . Millivac Instrument Corp, P. O. Box 3027, New Haven, Conn., offers the MV-15A dc **microvolt meter** with a full scale sensitivity of 10 microvolts with input impedance of 1,000 ohms.

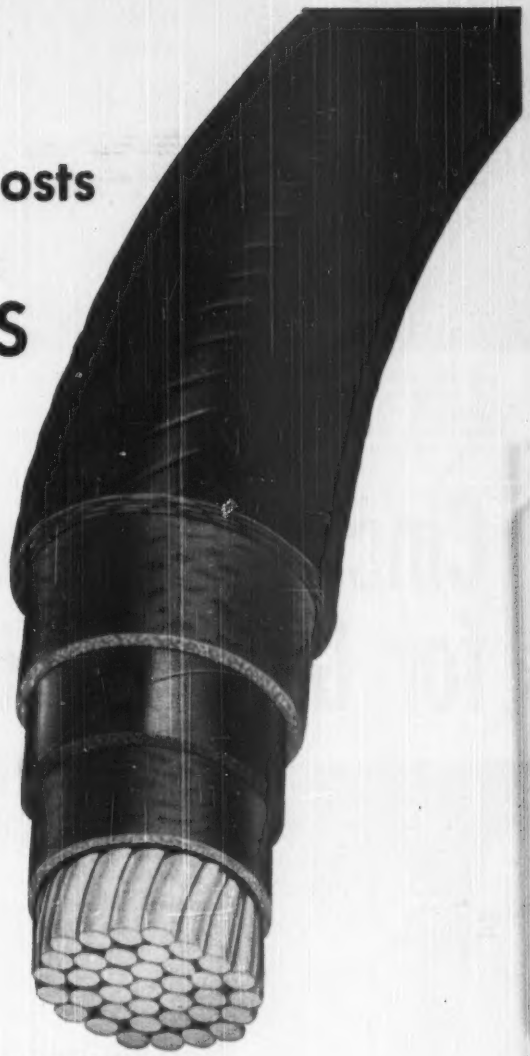
Curtis Lighting, Inc, Dept CSB, 6135 W. 65th St, Chicago 38, Ill., is marketing the Coronet line of fluorescent **luminaires** for use with lamps 4, 5, 6, and 8 ft long. Technical and illumination data is given in a 16-page bulletin. . . . The Electric Storage Battery Co, Allegheny Ave & 19th St, Philadelphia 32, Pa., has developed a new corrosion-proof process to protect aluminum alloy **battery compartments** used in aircraft.

Cut Installation Costs

WITH 30% SMALLER

ROCKBESTOS

A.V.C.®



USE A SMALLER CABLE!

With a 230 ampere load you use Size 000 A.V.C. instead of 300 MCM RH*.

SAVE ON CONDUIT!

You use 2-inch conduit rather than 2½-inch conduit.

SAVE ON FITTINGS!

You use smaller fittings—bushings, couplings, terminators, connectors, etc.

SAVE ON LABOR!

Because the cable is lighter, smaller, you can pull it through the conduit easier, faster, and, of course, *cheaper.*

The more efficient current carrying capacity of Rockbestos A.V.C. means plenty of savings for you. Write for the booklet "Cut Current Carrying Costs."

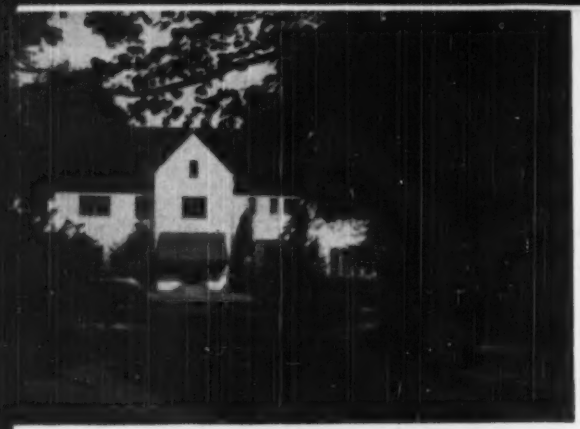
*Comparison with Type RH, 3 conductors in conduit, 40°C — (104°F). See Chapter X, National Electrical Code.

ROCKBESTOS PRODUCTS CORPORATION

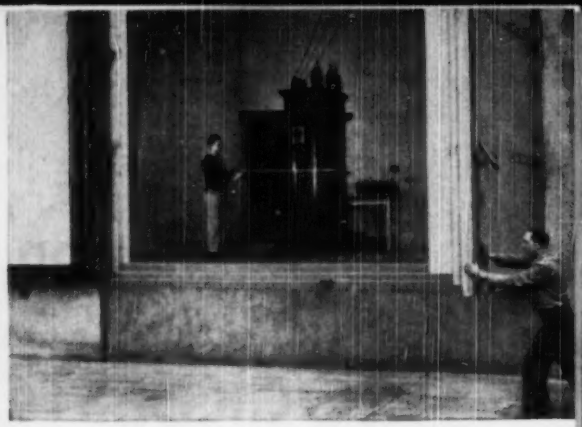
New Haven 4, Conn. • New York • Cleveland • Chicago • Detroit
Pittsburgh • St. Louis • New Orleans • Los Angeles • Oakland, Calif.

HI ...Your best buy

*Rockbestos A.V.C. has a Higher Ampere Rating



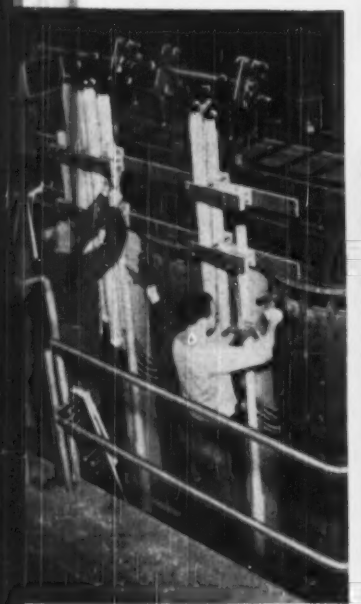
1 This attractive home in suburban Glendale is one of many served by the new 15,000 kva transformer. Since 1940 the population of Greater Cincinnati has increased over 10%. Residential Growth imposes new loads on electrical equipment as more lights and more electrical appliances draw power.

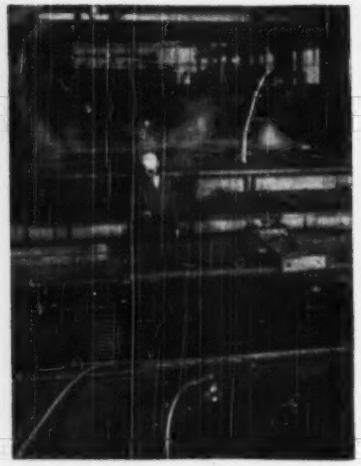


2 Research, engineering and production have teamed up at Allis-Chalmers to give you the best in quiet transformers. Here in the Pittsburgh Sound laboratory engineers make frequency, sound and harmonic analyses to help design low sound level transformers. They're putting improved performance into every type.

Cincinnati Gets More Power for Growing Residential Load

ALLIS-CHALMERS TRANSFORMER DISTRIBUTES 15,000 KVA TO CITY'S NORTH SIDE





3 Specialists complete the lead assembly. All leads are strongly supported in heavy machine wound tubes and securely braced against repeated short circuits. Ducts throughout windings and core efficiently cool transformer.

4 Radiators are made corrosion resistant by a 5-step bonderizing process and then rotary flow painted with two coats of tough, baked-on enamel. Bonderizing converts the metal surface to a non-metallic phosphate coating integral with the metal. Staggered fin arrangement makes routine periodic inspection easier.

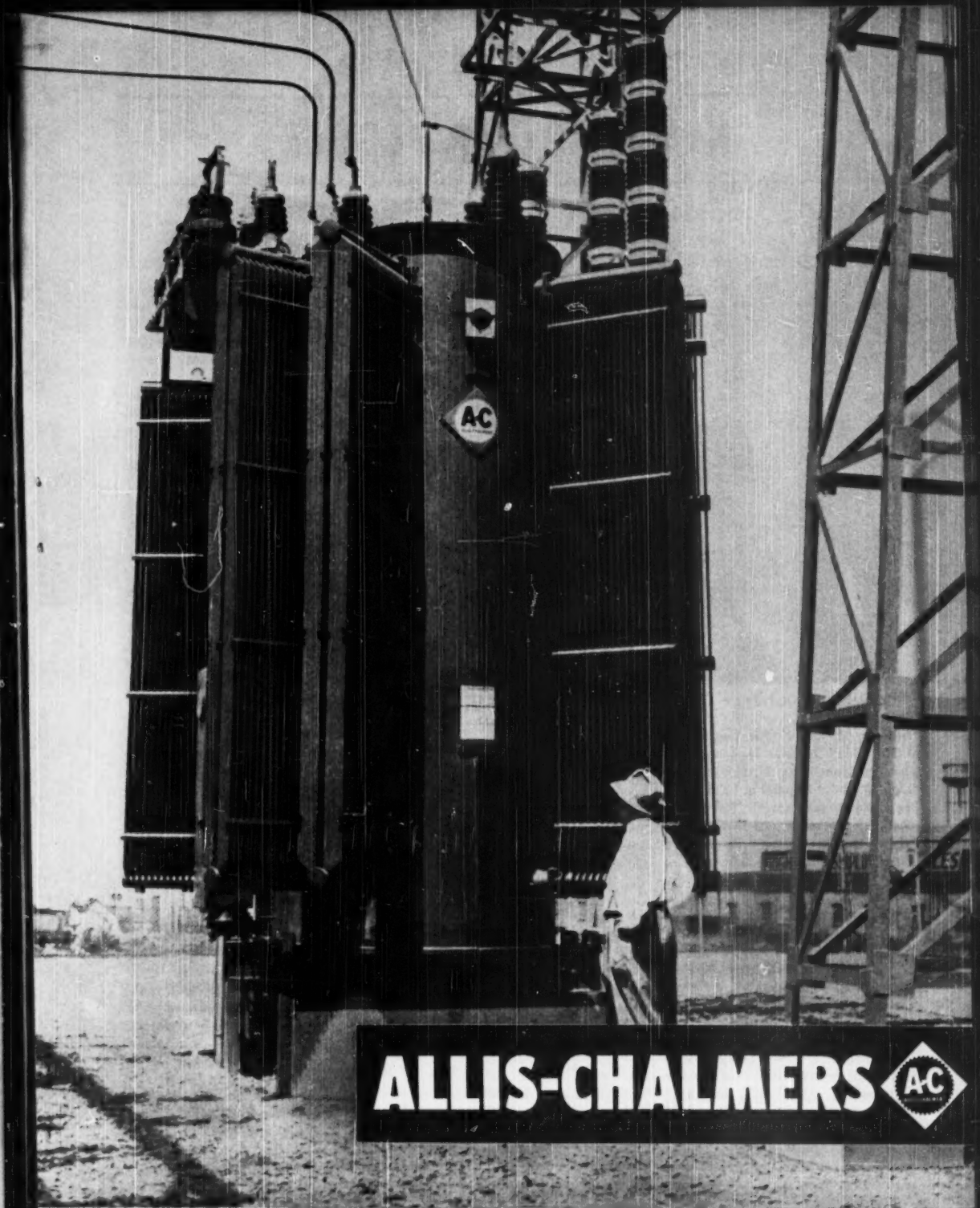
TO THE LOOP circuit encircling Cincinnati, the Cincinnati Gas and Electric Co. engineers added 15,000 kva to meet residential power demands on the city's North side. They installed a standard Allis-Chalmers transformer at the Woodlawn substation serving the communities of Mt. Healthy and Glendale.

For Cincinnati this 66/33 kv power transformer is a good investment that will pay off in economical, long time service. Controlled gasket compression, bonderized and flow-painted radiators, side operated tap changer, basic electrical design — all part of standard low maintenance construction — involve no special engineering costs.

Cincinnati Gas and Electric Co. engineers — no strangers to Allis-Chalmers transformer reliability — have installed many A-C transformers in the last 10 years. These include power, distribution and network transformers.

Building transformers for nation's growing power load is an old and important business at Allis-Chalmers. For standard design or specialized transformer engineering, Allis-Chalmers has the background and plant facilities to produce the transformer for your system. For information or service call in your A-C sales representative. Offices in 64 principal cities.

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.



ALLIS-CHALMERS

5 Homes in Cincinnati's suburbs, Mt. Healthy and Glendale, get more capacity for lighting and heating. This new 15,000 kva power transformer was installed to relieve increasing power demands in an expanding area. Accessories are located for maximum efficiency and convenience. Rated 66/33 kv, 3 phase, 60 cycles, the transformer has provision for forced air cooling. A-3162

NEWS ABOUT PEOPLE

New Hampshire Utility Elects Delaney, Buckley

Thomas H. Buckley, comptroller of Public Service Co of New Hampshire, and Burton W. Delaney, executive assistant, have been elected vice presidents of the utility.

Buckley studied accounting before becoming a messenger for Tucker,

THOMAS H. BUCKLEY

Anthony & Co, Boston bankers, in 1911. This house was fiscal agent for the then Manchester (N. H.) Traction, Light & Power Co, and in 1925 Buckley became assistant to the latter's treasurer. He continued in that position after the merger that formed Public Service in 1926.

The next year Buckley was appointed auditor, and in 1944 he became comptroller. He will continue in the latter post. He is a past president of the New Hampshire chapter of the National Association of Cost Accountants and a member of Edison Electric Institute's statistical committee.

Delaney, an electrical engineer, joined Brooklyn Edison Co's engineering department in 1926 but left the next year to enter Public Service at Manchester. He worked on plant field inventory, spent some time in the drafting department, and in 1934 was named assistant engineer in the rate engineering department.

During World War II he handled Office of Price Administration and

BURTON W. DELANEY

War Production Board matters for the company. He has been executive assistant since 1945. As vice president he will have charge of development and planning, rates, job analyses, and other investigations.

•

Howard E. Gismond has been appointed chief mechanical engineer of Dayton Power & Light Co. He will be responsible for design and construction of all mechanical equipment of the company's generating stations.

H. Cecil Webb has resigned as vice president of Puget Sound Power & Light Co, Seattle, to become general sales manager for Oklahoma Natural Gas Co, Tulsa. Assuming Webb's duties as general commercial manager for Puget Power will be **R. F. Plymire,** former assistant to the executive vice president. Webb joined Puget Power in 1937 and became a vice president in 1942. Plymire joined the company in 1930.

Ralph B. Grierson has been appointed rate engineer in charge of the rate division of Detroit Edison Co. He succeeds **Harry S. Lofquist,** who is retiring. Grierson joined Detroit Edison in 1937 as a student engineer in the construction engineering department, spent seven years in the company's electrical system, and was transferred to the rate division in 1947.

PEA Picks Congressman as Managing Director

Franklin H. Licthenwalter, Republican Congressman from the Eighth Congressional District of Pennsylvania, has been appointed managing director of the Pennsylvania Electric Association.

He succeeds A. B. Millar who has retired after 23 years of service. Before going to PEA Millar was secretary of the Pennsylvania Public Utility Commission and its predecessor, the Pennsylvania Railroad Commission.

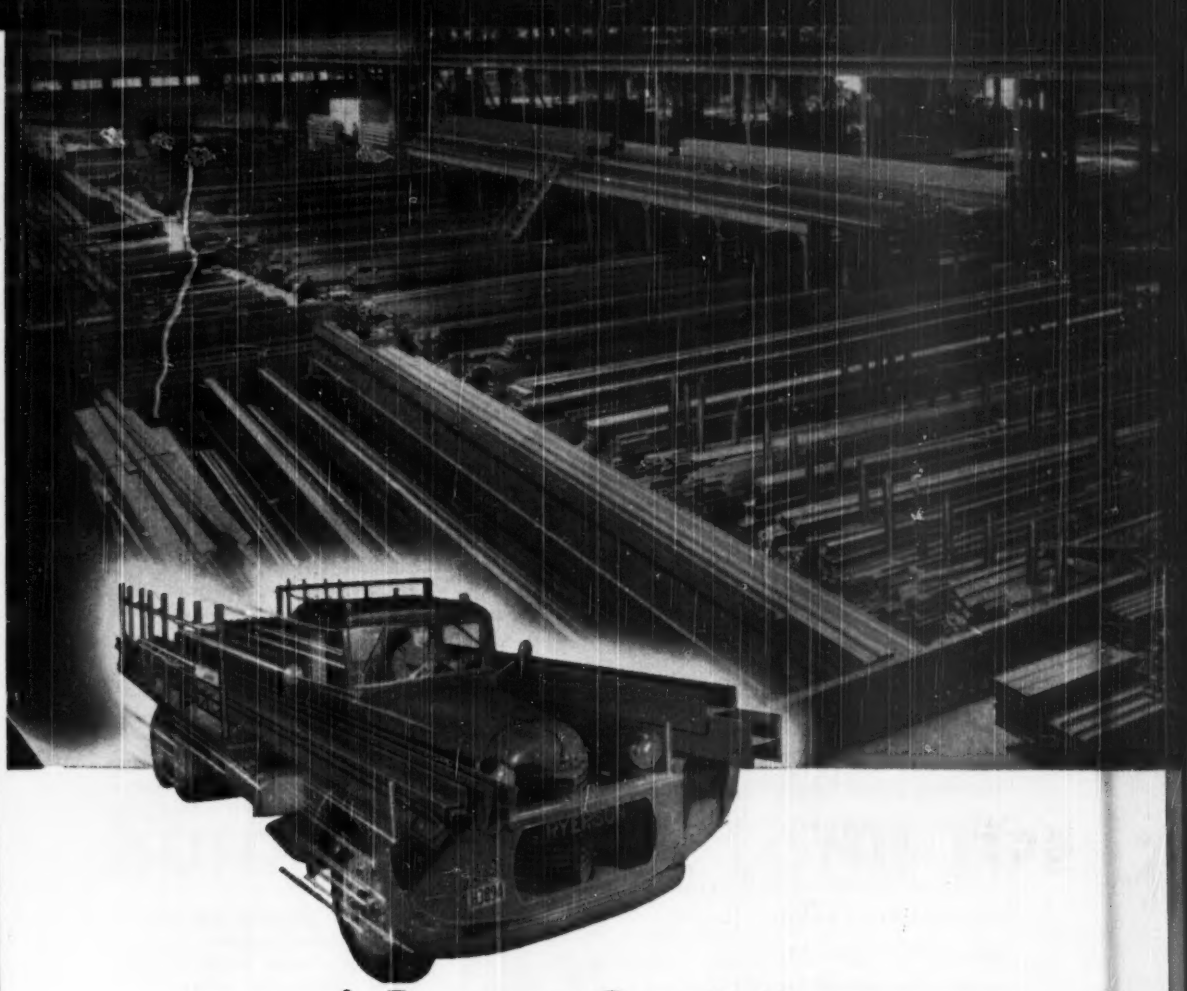
The new managing director has been in government service since 1938 when he was elected to the Pennsylvania House of Representatives. He was sent to the national House of Representatives by a special election held in 1947. Licthenwalter defeated Philip H. Storch, president of the Lehigh Valley unit of the American Newspaper Guild, in a contest that drew nationwide attention because it was fought on the issue of repeal of the Taft-Hartley Act. Storch was supported by organized labor groups.

Licthenwalter was reelected to the 81st Congress in 1948 and was a member of the Select Committee named to investigate the problems of small business. He did not run for reelection in 1950.

•

Robert J. Hyer has been named executive secretary of the Power and Communication Contractors Association. He succeeds **Larry H. Ellett,** who has resigned because of ill health. Hyer spent 10 years in private utility engineering work and 10 years with the Copper Wire Engineer's Association. Power and Communication Contractors Association formerly was known as the Rural Electrical Contractors Association. Headquarters are in Suite 318, Porter Building, 406 West 34th, Kansas City 2, Mo.

John P. Randolph has resigned as a member of the Missouri Public Service Commission to become general solicitor of the National Association of



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Steel Problems of Electric Utilities

Convenient to utilities from coast-to-coast are thirteen strategically placed Ryerson plants — each staffed with steel specialists experienced in working with utilities, each equipped to accurately cut or otherwise prepare your steel to exact specifications.

Many types and sizes are in short supply, but your special requirements may be among the carbon, alloy and stainless steels we have on hand for prompt shipment. And we are still anxious to work with you or your steel buying problems.

So whatever your steel needs—contact your nearest Ryerson Plant. You can be sure we'll do our level best to help you.

PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled and cold finished
STRUCTURALS — Channels, angles, beams, etc.
PLATES—Many types including Inland 4-Way Safety Plate
SHEETS—Hot and cold rolled, many types and coatings
TUBING—Seamless and welded, mechanical and boiler tubes
ALLOYS—Hot rolled, cold finished, heat treated
STAINLESS—Allegheny bars, plates, sheets, tubes, etc.
REINFORCING—Bars and accessories, spirals, wire mesh
BABBITT—Glyco bearing metal, also Ryertex plastic bearings
MACHINERY & TOOLS—For metal fabrication

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JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND
DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO

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In the field of electronics and the electrical goods industry, MOSINEE is known for its *dependable uniformity*, and its scientifically controlled physical and chemical properties, such as:

Good dielectric strength . . . proper softness or stiffness . . . high tensile or tear strength . . . creped with controlled stretch or flexibility . . . specified pH for maximum-minimum acidity or alkalinity . . . accurate caliper, density, liquid repellency or absorbency.

If you have a fabricating or processing problem involving paper, a discussion with MOSINEE technicians might prove helpful. Please write Dept. EW.

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"Essential Paper Manufacturers"

Railroad and Utilities Commissioners. Randolph spent some 25 years in general practice of law in Missouri and federal courts. He was named general counsel to the PSC in 1940 and a member in 1949.

•

Petroleum Power Group Elects Patrick President

R. E. Patrick, Kansas Gas & Electric Co, has been elected president of the Petroleum Electric Power Association.

New vice president is T. E. Graham, Oklahoma Gas & Electric Co. Ned Beaudreau, Central Power & Light Co, Corpus Christi, Texas, was named secretary-treasurer. Directors chosen were J. W. Lambert, Southwestern Public Service Co, Amarillo, Texas; Beaudreau; R. N. Crossman, Texas Power & Light Co; Jim Moody, Southwestern Gas & Electric Co, Shreveport, La.; and Graham.

•

Dr. B. Richard Teare, Jr, has been appointed dean of graduate studies in Carnegie Institute of Technology's College of Engineering and Science. He will retain his posts as head of the electrical engineering department and Buhl professor of electrical engineering.

George B. Fahlstrom has been appointed research and development director of Osmose Wood Preserving Co of America, Inc, Buffalo, N. Y. He has done research work on the chemistry of wood preservatives at the Forest Products Laboratory in Madison, Wis., and more recently has been a chemical and wood technologist with Borden Co.

Samuel Graff Miller has been appointed assistant general counsel of Philadelphia Electric Co. He has been with the utility since 1947. Before that he was in private law practice in Harrisburg, Pa., and for several years served as assistant counsel of the Pennsylvania Public Utility Commission there.

W. H. Rodgers, Jr, formerly advertising manager of Pennsylvania Power & Light Co, has been appointed manager of the company's newly created advertising and publicity department and will report to J. M. Huebner, vice president. Rodgers joined the company in 1925, left to work for Bethle-

ANOTHER
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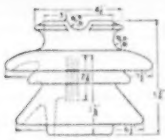
THAT SAVES
AS IT SERVES

VICTOR

TRANSMISSION PINTYPE INSULATORS

No. 245

BUILT FOR EXTRA LONG LIFE!



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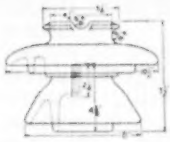

No. 245

VICTOR Catalog No.		127	245
Nominal Voltage Rating		27	45
60 cycle dry flashover	KV.	95	125
60 cycle wet flashover	KV.	60	80
Dry arcing distance	In.	7	9½
Leakage distance	In.	13	21
Pinhole diameter	In.	1⅜	1⅜
Cantilever strength	Lbs.	2,500	3,000
RNI (plain)	MV.	8,000	16,000
RNI (radio-freed)	MV.	100	200
1000 KC at applied	KV.	15	30

FACTS—*actual performance data* obtained from installations throughout the country—prove that VICTOR transmission pintype insulators *retain* their original high standards after *years and years* of severe service on the job. This means *extra* years of trouble-free insulator service.

The extra service-years you get in *every* VICTOR pintype insulator are a result of such built-in features as: Construction of the *best* high voltage porcelain, a rugged, *self-cleaning* design, and a *special "cushion" coating* at the joining surfaces that *eliminates* problems caused by thermal expansion.

Reap the benefits of long, dependable service—*standardize* on VICTOR transmission pintype insulators.

For more information consult our new Condensed Catalog No. 4, write us, or call your VICTOR representative.

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INSULATORS Inc.
VICTOR, NEW YORK

Look for this trade mark of enduring service

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Make COLLYER your source for Overhead Service Cable... either standard or made-to-order.

NEUTRAL SUPPORTED CABLES

One, two, three or more phase conductors spiralled around the supporting neutral conductor.

1. **DOUBLE LAYER TYPE** — Phase wires have double-layer covering — Performance Grade Rubber Insulation protected by outer sheath of abrasion resistant Neoprene.
2. **SINGLE LAYER TYPE** — Phase wires have single layer covering of Insulating Neoprene.

TWISTED CABLES

Two, three or more conductors insulated with Performance Grade Rubber.

1. **RUBBER and BRAID TYPES**—(a) Conductors twisted together and covered with weather and flame resistant braid. (b) Conductors covered with moisture resistant braid. Twisted cable covered with moisture resistant braid. (c) Conductors covered with weather and flame resistant braid . . . then twisted together. One conductor often of double or triple weather proof wire to serve as the neutral.
2. **RUBBER and NEOPRENE TYPE** — Conductors sheathed with abrasion resistant Neoprene . . . then twisted together. One conductor often of Neoprene line wire to serve as the neutral.

CONCENTRIC NEUTRAL CABLES

One, two, three or more phase conductors insulated with Performance Grade Rubber, sheathed with Neoprene, phase conductors assembled either parallel or twisted.

1. **NEOPRENE JACKETED TYPE** — Neutral conductor consisting of many small copper wires applied concentrically . . . then protected with a sheath of abrasion resistant Neoprene.
2. **EMBEDDED NEUTRAL TYPE** — Neutral conductor (many small copper wires applied concentrically) embedded in a covering of felted unspun cotton — weather-resistant finish.

OPEN WIRE SERVICES

Copper or aluminum conductors covered with Neoprene or Polyethylene.

NATIONAL ELECTRIC CODE STANDARDS

Type SD Service drop cables. Type SE, Style A, armored service entrance cable. Type SE, Style U, unarmored Service entrance cable.

Let us know your needs for any and all types of overhead service cables. Write for recommendations.

COLLYER INSULATED WIRE CO.
245 ROOSEVELT AVENUE, PAWTUCKET, R. I.

CHOOSE *Collyer*

hem Steel Co and a New York financial organization, and returned to PP&L in 1930 as a member of its sales department. Three years later he was made assistant manager of the advertising department and in 1940 advertising manager.

Elmer Titus, former Oregon Rural Electrification Administration superintendent of safety and job training, has been appointed superintendent of Franklin County (Wash.) Public Utility District. He succeeds George Hibbert, who resigned after holding the position only one month.

Robert K. Spofford has been named director of purchases for John A. Roebling's Sons Co, Trenton, N. J. For the past seven years he has been with Okonite Co, five of them as purchasing agent. Before that he was assistant to the supervisor of purchases for Continental Can Co, Inc.

Leland S. Person has been appointed division manager of Central Vermont Public Service Corp with headquarters at Middlebury. He succeeds **Chester A. Ingalls,** retiring after 40 years' service. Person joined the company in 1949. Ingalls began as a station operator and was an operating superintendent for many years.

Robert J. Wimberley has been named administrative assistant to Pres C. Hamilton Moses of Arkansas Power & Light Co, succeeding **Minor C. Summers,** now president of the new Mid-South Gas Co. Wimberley was a newspaper man before joining AP&L two years ago as assistant advertising manager.

Willis Laurens Emery has been named associate professor of electrical engineering at the University of Illinois. He formerly taught at the University of Utah.

J. W. A. Fleury, industrial psychologist and personnel director for British Columbia Electric Railway Co for the past five years, has resigned to enter private practice.

Clarence F. Scott has been named Lincolnton manager of Georgia Power Co. He has been in charge of the utility's service department.

Wilbur R. Leopold has been appointed assistant to Vice Pres T. Cruthers of Worthington Pump & Machinery Corp, Harrison, N. J., to work on pub-

Chemical Brush Control

by the mile!

Today, miles of right-of-way are being cleared with Esteron Brush Killer. This widely used Dow formulation now contains more powerful type esters of 2,4-D and 2,4,5-T—effective against a wider variety of brush and weeds and much less volatile than materials previously available. It controls alder, ash, birch, brambles, cherry, elm, hickory, maple, oaks, osage orange, poison ivy, sumac, willow and other hard-to-kill species—also prevents resprouting of stubs and stumps.

Dow has approached brush control problems *from your side.* We are in a position to offer valuable assistance to help you decrease clearing costs—simplify maintenance—and increase efficiency of airplane patrol of power lines. We will gladly furnish you with a list of responsible service organizations engaged in the application of chemicals for right-of-way vegetation control.

Your inquiries are invited.

Agricultural Chemical Division
THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

Also recommended for woody plant control are Esteron 44 and Esteron 245. Where brush is not a problem—2-4 Dow Weed Killer, Formula 40 controls a long list of annual and perennial weeds. For controlling Johnson, quack, Bermuda and other perennial and annual grasses—also palmetto—use Dow Sodium TCA 90%. No fire hazard—and grazing cattle will not be poisoned.

DOW

CHEMICALS

INDISPENSABLE TO INDUSTRY AND AGRICULTURE

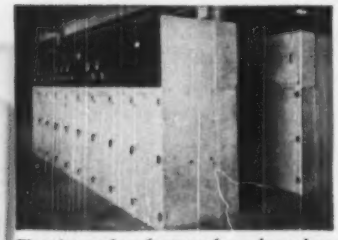
USE DEPENDABLE DOW AGRICULTURAL CHEMICAL PRODUCTS

WEED AND GRASS KILLERS • INSECTICIDES • FUNGICIDES
SEED PROTECTANT • PLANT GROWTH REGULATORS
GRAIN AND SOIL FUMIGANTS • WOOD PRESERVATIVE

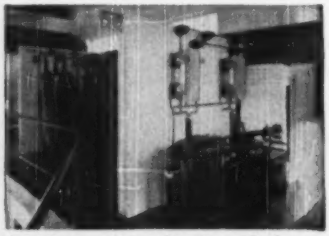
WHY STATION EXPANSION PROGRESSES FASTER . . . COSTS LESS

with Trancell Materials

If you're planning to expand your power stations or substation facilities, do what many leading power companies have already done . . . make your station change-overs with Johns-Manville Trancell Materials.



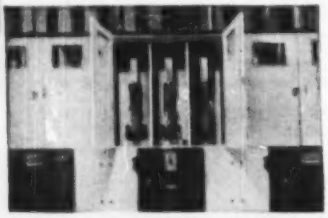
They're safe—fireproof . . . have low heat conductivity . . . adequately isolate high-voltage apparatus.



They're neat—make clean, flush-type housings, panels, doors, and partitions.

They're handy—easily cut and drilled on the job, or furnished cut to your specifications.

They're durable—rotproof and rustproof . . . will last for years. Require a minimum of maintenance.



They're economical—light, easy to handle and assemble. Have excellent re-use value.

—for all high voltage power equipment enclosures—Johns-Manville Trancell Materials are made in many sizes and types. Recommended for transformer and switch gear housings and partitions; bus bar enclosures and other services. For further information write to Johns-Manville, Box 290, New York 16, New York.

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an asbestos product for housing electrical equipment

lic works projects. He has been manager of the Detroit office for the past five years. He started with Worthington in 1917 as a sales trainee and later served as meter salesman in New York, meter representative and general line salesman in Pittsburgh, assistant sales manager of the Chicago office, and Western manager of the railroad division.

George E. Dean has been named distribution engineer in the electric distribution department of Public Service Electric & Gas Co, Newark, N. J. He succeeds Charles H. Lewis, who retired recently. **George A. Ewald** will succeed Dean as distribution plant engineer. Dean joined Public Service as a cadet engineer in 1922, and Ewald started as an assistant engineer in 1924.

A. Floyd Wray has been made manager of the Niagara district of Niagara Mohawk Power Corp. He has been manager of the Rome district. Two Niagara Falls officials, **Francis X. Doherty,** formerly vice president and general manager of Niagara Falls Power Co, and **Wilfred C. Stephens,** resident manager of the Niagara district, have been assigned to divisional duties in the Buffalo headquarters office.

Eldon E. Fox has been appointed advertising manager of Minneapolis-Honeywell Regulator Co. Fox has been with Young & Rubican, Inc, New York, since 1941 in the media and research departments and later as account executive.

Haskell G. Bohn has been appointed Clinton, Ill., manager of Illinois Power Co. He succeeds **Ralph Karr,** who has resigned.

OBITUARY

John S. Rowan, 62, chairman of the board of Rowan Controller Co, Baltimore, died in Baltimore Dec 5 after a long illness. Rowan founded his company in 1914 to build oil-immersed industrial motor controls for hazardous areas. He was a member of the National Electrical Manufacturers Association.

Frederic Glander, 62, retired general purchasing agent for Foster-Wheeler Corp, New York, died Dec 4 in New York. A mechanical engineer, he retired from Foster-Wheeler in 1948.

BERYLCO
BERYLLIUM COPPER

improves performance... cuts costs in ASCO SWITCHES

Here are four springs that never get tired . . . that operate with day-after-day precision . . . even under the most adverse conditions.

In this, as in many applications, beryllium copper alone has the necessary mechanical and electrical properties for desired performance.

Used for lighting loads up to 200 amperes, this magnetically-operated, mechanically-held remote control switch is built by Automatic Switch Co. The four beryllium copper springs fabricated by Instrument Specialties Co., Inc., from BERYLCO 25 alloy, are held to close dimensional tolerances for economy in assembly and dependability in service.

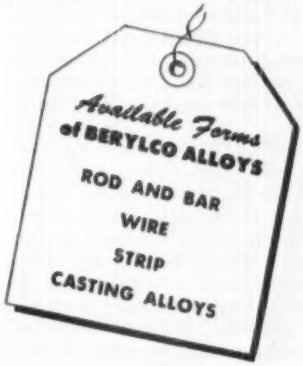
Among the many advantages of BERYLCO alloys are good electrical and thermal conductivity, high elastic and endurance strength, excellent resistance to wear and corrosion, freedom from drift and relaxation and peak operating efficiency from sub-zero to moderately elevated temperatures. If these properties suggest a solution to your problem, write today, giving full details with a drawing or sample of the part.

LONG CORE SPRING— non-magnetic for operation in solenoid field . . . corrosion resistant for outdoor installation . . . close limits on load deflection rate, free length and coil diameter to meet exacting operating requirements.

SHORT COMPRESSION SPRING— maintains desired contact pressure without set at elevated temperatures.

TORSION SPRING—high strength for maximum power in operating linkage.

FLAT SPRING — dimensional control through fixture heat treatment for accurate positioning of arcing contacts.



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MANUFACTURERS and MARKETS

Forthcoming Tightening of Controls May Help Utilities, Manufacturers

Chinese intervention in Korea means that controls will enter a new, tougher stage beyond the first "easy" controls and the intermediate period we are in now.

But the new trend in controls could mean fewer—instead of more—headaches for electric utilities and electrical manufacturers. The reason is that the utilities and their suppliers have been lumped in with the rest of the civilian economy thus far in the National Production Authority's controls orders. As military demands grow, civilian supplies will tighten. This will mean allocations and scheduling of materials, price and wage controls, and all the other trappings of a fully controlled economy. And when these come, the electric utilities and their equipment will be near the top of any priority roster for non-military supply needs.

CMP Likely in Spring

A revived "Controlled Materials Plan" may come as soon as April, Washington observers now predict.

Meanwhile, electrical manufacturers have no exemption from cutbacks handed out by NPA, and the utilities have only one temporary stay —from the aluminum conservation order.

The basic NPA priority is the "DO" (defense order) which can be used only by the military and the Atomic Energy Commission. Two other priority-type devices are being used as well — "scheduled programs" and "special directives." These could be used to break bottlenecks in electrical generating equipment production or utility construction, but so far they have not been needed.

Non-Priority-Type Controls

Meanwhile NPA has imposed three other types of industry controls: Conservation (cutback) orders; inventory limitations, and end-use restrictions.

Conservation orders thus far specify the following civilian use for critical materials: Aluminum, 80% of normal in January, 75% in February, 65% in March; copper, 85% in January and February, 80% in March; nickel, 65% in the first quarter of 1951; zinc, 80% in the first half of 1951; cobalt, civilian usage set monthly by NPA; columbium steel, no specific civilian use set.

One Temporary Exemption Granted

Electric utilities were exempted for conductor from the aluminum order through the first quarter of next year. They had expected to get—but didn't —a similar exemption from the copper order. Interior's Defense Power Administration is surveying utility requirements of aluminum, copper, and steel for the last three quarters of 1951. The industry is expected to receive allocations based on these estimates. DPA will get the job of distributing the electric utilities' share of these metals.

Electrical manufacturers are not within DPA's scope, and their representation in controls councils is through the Power Equipment Division at NPA. This office is just getting organized and has not yet begun to formalize industry needs.

No Inventory Order Exceptions

Neither utilities nor equipment manufacturers have any exemptions from the inventory orders which have been handed down with the cutbacks. Supplies that may be kept in inventory are aluminum, 60 days; copper, 45 days for fabricators, 60 days for users; nickel, 30 days; zinc, 45 days; tin, 60 days; and cobalt, 20 days.

The end-use restriction has been used only once, to stop amusement-type construction. But there are orders in the works for more of this type of curtailment—and promising new help for more essential civilian users such as makers of electrical generating equipment. The new orders would halt or limit manufacture of such things as ash trays from tight materials like copper and aluminum.

•

Use for Pole Treatment of Creosote Up in 1949

Preservative treatment of poles processed for utility use in 1949 took 1.6% more creosote and creosote-coal tar in 1949 than in 1948. The figure reported by the American Wood-Preservers' Association for last year was 200,504,952 gal.

Petroleum used for mixtures with creosote or other preservatives totaled 36,286,916 gal, a slight decrease. Use of all other types of preservatives declined.

The largest decreases were in chromated zinc chloride (75%), of which 2,903,587 lb were used in 1949; pentachlorophenol (25%), 2,288,614 lb; and Wolman salts (22%), 1,003,992 lb.

Total number of poles treated last year was 6,031,746, of which 5,265,068 were full-length pressure treated. Of this total Southern yellow pine comprised 4,534,847, all but 9,151 of which were pressure treated. Western red cedar represented 490,056, but only 6,884 of these were pressure treated.

•

S. Morgan Smith Co Buys Philadelphia Valve Maker

S. Morgan Smith Co, New York hydraulic turbine and valve manufacturer, has bought R-S Products Corp, Philadelphia. Terms of the purchase were not announced.

Acquisition of R-S, which has 85 employees and 30,000 sq ft of floor space, will increase Smith Co's employment and manufacturing capacity by about 10%. Combined operations will permit sales of valves of all sizes. R-S makes butterfly valves up to 48 in. used for controlling the flow of liquids in power plants and other industries, and it also has specialized in large

KEEP METAL SURFACES AND CONTACTS *CORROSION FREE* WITH NO-OX-ID "A SPECIAL"

It's a simple matter to eliminate formation of oxides, sulphides and other corrosion deposits on metal surfaces and contacts. Just coat the part with NO-OX-ID "A Special" . . . the Dearborn rust preventive of a hundred uses in the utility field.

NO-OX-ID "A Special" is a heavy duty, chemically inhibited compound recommended by manufacturers to provide trouble-free joint connections . . . impervious to weather, corrosive fumes, high humidities, water immersion. It is economical to use, easy to apply, easy to remove.

Check the advantages of NO-OX-ID "A Special." Put it to profitable use in your shops . . . on maintenance and repair trucks. Mail the coupon for further, helpful information.

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Switch blades	Brackets
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Aluminum cable	Wire
Connectors	Aerial cable
Clamps	Turnbuckles
Steel light poles	Manhole hardware

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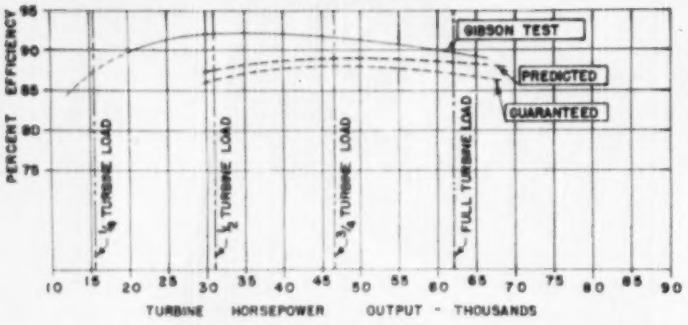
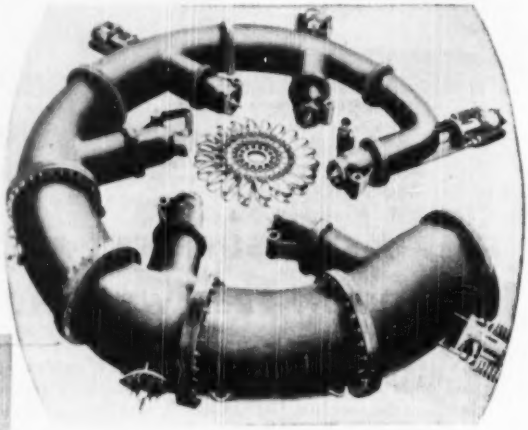
Another WORLD RECORD



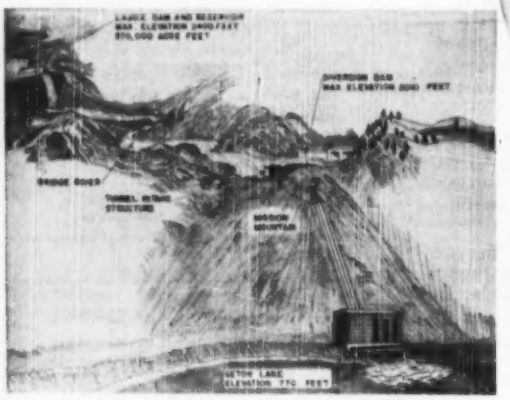
Guaranteed, predicted and official Gibson Test performance of Bridge River Turbine.

Schematic arrangement of the 6-nozzle vertical impulse turbine developed by Pelton for the Bridge River Hydro project.



Rivaling the spectacular performance of the jet engine, these "jet-power" impulse turbines, designed and built by Pelton Water Wheel Company, a Baldwin subsidiary, have achieved another world record in hydro-power development.

Specified by the British Columbia Electric Railway Co., Ltd., to produce a guaranteed efficiency of 88% and a predicted efficiency of 89%, with a present gross head of 1226′ and maximum future gross head of 1360′, the first 62,000 hp unit, driving a 50,000 kva generator at 300 rpm, showed a Gibson Test efficiency of 92% maximum, and maintained a plus-90% efficiency over practically 80% of its operating range.



Diagrammatic view of the mammoth Bridge River development. Power potential is estimated at 600,000 hp. Three Pelton-built units are now in successful operation.

Normal practice would have called for a reaction turbine in this installation.

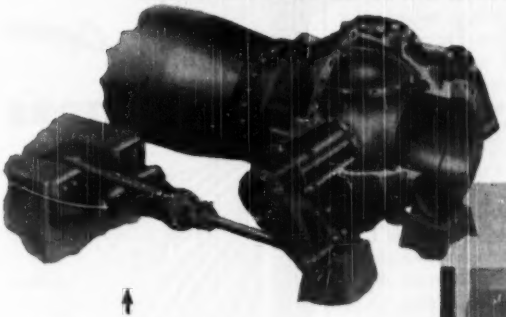
Since the water was highly silted, an impulse turbine was preferred . . . and to conserve power house space, a vertical, multi-nozzle unit was the most desirable type.

Extensive laboratory scale-model tests and flow studies, conducted by a large staff of engineers over a long period, produced a design that not only

BALDWIN

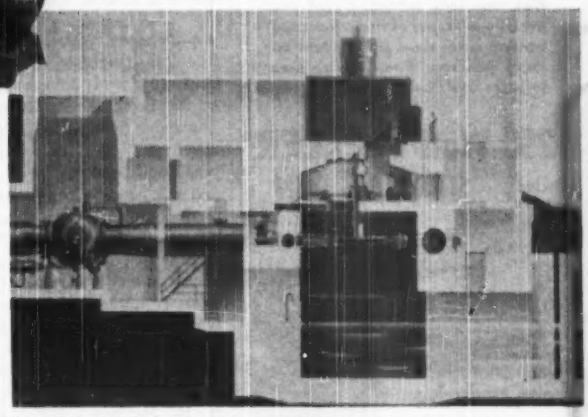
by BALDWIN

with PELTON WATER WHEEL COMPANY VERTICAL SHAFT MULTI-NOZZLE IMPULSE HYDRAULIC TURBINES



The main spherical-type inlet valve, developed by extension of model-valve data, provides uninterrupted flow passage when open, and exceptional tight seating.

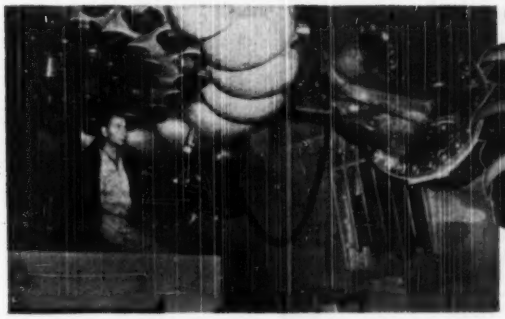
Pictorial illustration of arrangement of turbine and inlet valve in power house. Arrangement conserves power house space, and an elaborate draft-tube is not required.



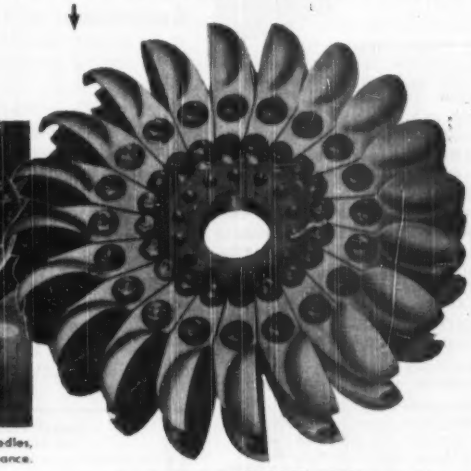
Runner is formed of 20 cast steel buckets, bolted to a solid steel disc, and is believed to be the largest capacity runner of its type.

eliminated past shortcomings of the vertical impulse turbine, but produced efficiencies comparable, to, or greater than, those obtained from the best reaction turbines.

This installation demonstrates again that the greatest value of Baldwin experience is not in duplicating the past—but in pioneering for the future. This experience is at your service, in working out the most desirable solution to your hydro-development problems. Ask for our Bulletin on the Bridge River Project.



This view in the pit shows the ease of access. Runner, deflectors, needles, points, and nozzles are all easily reached for inspection and maintenance.



HYDRAULIC TURBINES

BALDWIN-LIMA-HAMILTON CORPORATION
Philadelphia 42, Pa.

THE PELTON WATER WHEEL COMPANY
2929 Nineteenth Street, San Francisco 10, Calif.

Offices: Boston, Chicago, Cleveland, Houston, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis, Washington.

The ONLY Soldering Tool You Need for light or HEAVY Work!

Switch *instantly* from light to heavy work—or vice versa—with the 250-watt Weller Soldering Gun. *Controlled* dual heat makes the Weller Gun the only soldering tool you need for *all types* of work. 5-second heating saves time and current on every job, too. Your Weller Gun pays for itself in a few months!

250-Watt WELLER SOLDERING GUN

√ Check these exclusive features

- **TRIGGER-SWITCH CONTROL** Governs heat and saves power because no need to unplug gun between jobs. Heat goes off when you release trigger.
- **5-SECOND HEATING**—No waiting, no wasted current. Saves hours and dollars each month.
- **SOLDERLITE**—Spotlights the work. Lets you see what you're doing at all times, even in dark corners.
- **LONGER REACH**—Lets you get at any job with ease. Slides between wiring, into the tightest spots.
- **STREAMLINED**—Compact and comfortable to hold. Pistol-balanced for fast precision soldering.
- **WELLERTIP**—Rigid and chisel-shaped with more area for faster heat transfer. Over/under terminals brace tip, give greater visibility.
- **DUAL HEAT**—Single heat 200 watts; dual heat 200/250 watts; 120 volts; 60 cycles.

See the all-purpose Weller Soldering Gun today at your distributor—or write for bulletin direct.

SOLDERING GUIDE—Get your new copy of SOLDERING TIPS—revised, up-to-date and fully illustrated 20-page booklet of practical soldering suggestions. Price 10c at your distributor, or order direct.

WELLER ELECTRIC CORP.
817 Packer Street, Easton, Pa.

made-to-order industrial heat treating furnaces. R-S will be operated as a Smith Co subsidiary with its present management retained.

MANUFACTURING BRIEFS

Allis-Chalmers Manufacturing Co has set up a new warehouse sales unit as a section in the Chicago district office to handle sales of small apparatus, including motors, controls, Texrope drives, and pumps. George A. Wampler, who has been a sales representative in the Memphis district, will head the new unit, which will be at 500 East 27th St, Chicago.

Westinghouse Electric Corp has moved its stock of light bulbs for New England into a newly completed warehouse at 30 Brighton St, Belmont, Mass. The move to the new building, which has 35,000 sq ft of warehouse floor space and 5,000 sq ft of office area and can store 12 million bulbs, has increased by 70% the company's lamp warehouse capacity.

Richardson-Allen Corp, maker of selenium rectifiers for conversion of ac to dc, battery chargers, and various types of industrial controls, has moved to a new office and factory at 116-15 Fifteenth Ave, College Point, L. I., N. Y. The new location will provide expanded facilities.

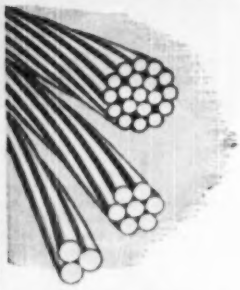
General Electric Co of England, which so far has only sales offices in Canada, is considering establishing a plant in Vancouver, B. C. The company, one of the world's largest electrical equipment makers, operates more than a dozen main factories in the United Kingdom, employing nearly 60,000 persons.

Sprague Electric Co, North Adams, Mass., has leased 130,000 sq ft more of space in the Nashua, N. H., plant where it has been using about 30,000 sq ft of manufacturing space. The company will use the new facilities to increase its capacitor output.

Metal Prices
Dec 11, 1950

COPPER, Conn. V., lb	$ .24½
LEAD, N. Y. lb	.17
ZINC, prime Western, E. St. Louis, lb	.17½
TIN, Straits quot. N. Y., lb	1.41
ALUMINUM, ingot, base price	.19
NICKEL, base price	.48
STEEL, billets, Pitts., ton	53.00
STEEL, scrap, No. 1 heavy, Pitts., ton	46.50

PAGE Stainless Steel STRAND and Stainless-Copper CONDUCTORS



Here's WHY they Save

Compared with other types strand of equal breaking strength, they . . .

- have 30-40% greater overload capacity within elastic limit
- resist corrosion all the way through—not merely through a thin case of soft metal
- offer highest tensile and vibration-fatigue strength (tensile strength 235,000 psi; corrosion-fatigue limit 50% of ultimate)

Here's HOW they Save

- They permit longer spans—therefore require fewer poles per mile.
- Being lighter, they are easier and faster to install in the field.
- More resistant to destructive factors, they last many times as long before replacement.

Let us tell you the whole story—specific data, prices, recommended sizes.

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

Buell van Tongeren Cyclones Can Help You...

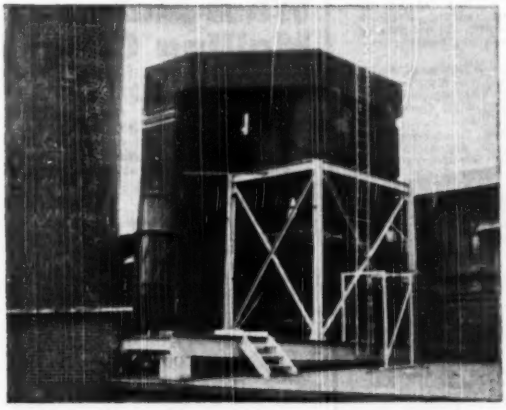
DO A REAL JOB of FLY-ASH COLLECTION on PULVERIZED COAL-FIRED BOILERS!

In plant after plant, where pulverized coal-fired boilers have presented seemingly fathomlesss fly-ash problems, Buell has come up with the answer.

Stated simply it is this: Sustained peak efficiency . . . with the exclusive van Tongeren Cyclone. PLUS—clog-proof, low maintenance construction.

What's more, with a Buell fly-ash collection system *you know your efficiencies beforehand!* You get a true indication of the actual performance of your Buell System—on the job! Performance that has proved capable of meeting even the most stringent demands (of local air pollution ordnances).

If you have a serious fly-ash collection problem, an inquiry will bring help in a hurry. Please address request for information to: Buell Engineering Company, Suite 5050, 70 Pine Street, New York 5, N. Y.



● After an exhaustive 5-year study, engineers at a Southern paper mill selected Buell van Tongeren Cyclones for their three pulverized-coal-fired boilers.

buell

Engineered Efficiency in **Fly Ash Collection**

HANDY ANDY SAYS:

When you have to plug it... plug it up with

Johns-Manville

DUXSEAL

DUXSEAL—the plastic plugger-upper—can do more work for you with less effort than almost anything you can name. Work-conscious electricians have taken advantage of the effortless application characteristics of Duxseal for years . . . to plug up openings around service boxes, cable entrances, conduit ends . . . to fill up small holes in foundations.

Remains soft—Duxseal stays soft indefinitely, but will not slump, melt or run under ordinary temperatures.

Remains tight—Clings to duct walls and cables but gives with expansion or contraction of the cable.

Remains insoluble—Unaffected by ground waters and gases.

Remains harmless—Will not injure workmen's hands or react with rubber, metals or painted surfaces.

Tight seals for other electrical uses:

J-M Tranolseal . . . for use with electrical equipment using dielectric oils.

J-M Uniseal . . . for caulking against weather and humidity. Resists temperatures up to 180 F.

If you would like to know more about Duxseal and these other labor-saving sealing compounds, write Johns-Manville, Box 290, New York 16, N. Y.

JM

Johns-Manville

SEALING COMPOUNDS

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Ala., Birmingham—Westinghouse Electric Corp., Comer Bldg., plant and warehouse, $1,500,000. Lawrence Whitter-Brown-Marx Bldg., archts.

Fla., Jacksonville—City, City Hall condenser tubes for South Side Generating Plant. Utilities Eng.-Mgr., Utilities Bldg., Zone 2, engr., furnishing transformers, controls, facilities at McDuff Ave. Substation, Spec. 1039; 1 300 kva portable electric sub-station, Spec. 1040.

Fla., Key West—Steam electric generating station, $3,000,000. Plans deposit $100. R. W. Beck & Assoc., Colorado Springs, Colo., engrs.

Ill., Chicago—Commonwealth Edison Co., 72 W. Adams St., Zone 3, 1 story, steel, concrete, brick, Saugnash Sub-Station, 6033 N. Crawford Ave. $400,000. Shaw Metz & Dollo, 208 S. La Salle St., Zone 4, archts.

Ia., Keosauqua—City, power plant exten., improvs., wiring, cable distribution. Harold Hoskins & Assocs., 231 N. 11 St., Lincoln, Neb., engrs.

La., New Orleans—New Orleans Sewer & Water Bd., 526 Carondelet St., Contr. 734 S, installing underground power cable.

Md., White Oak—Public Wks. Office, Potomac River Naval Command, Naval Gun Factory, Wash., D. C., installation of piping and electrical equip. for continuous wind tunnel in Bldg. 403, and concrete pipe tunnel between Bldg. 402 and 403 at Naval Ordnance Laboratory, NOY 16863, Spec 20757. Plans deposit $40.

Mass., Chelsea—Commonwealth of Mass., Bd. Trustees Soldiers Home, 91 Crest Ave., power plant imprvts., Soldiers Home, Crest Ave. **$155,000.** The Office of Hollis French, 210 South St., Boston, consult. engr.

Mich., Trenton—At office Schley & Ward, archts., 16851 James Couzens Hy., Detroit, steel, brick transmitter radio station, towers and control bldg. for WJR Good Will Station, Trenton.

N. Y., New York—Bd. Transportation, 250 Hudson St., Zone 13, furnishing, installing two 20,000 kw. frequency converters for 74 Street Power Plant, Manhattan Boro.

Oklahoma—Grand River Dam Auth., Vinita, 69,000 volt transmission line from Camp Gruber to Salisaw, Sequoyah Co. **$175,000.** W. R. Holway, 302 E. 18 St., Tulsa, consult. engr.

Pennsylvania—State Hy. Dpt., Harrisburg, complete electrical sys. in Squirrel Hill Tunnel consisting of 2 tubes, 2 ventilation buildings and in the plaza areas from each tunnel portal and to install the damper operating mechanism, U. S. Routes 22 and 30, city of Pittsburgh, Allegheny Co.

Pa., Embreeville—General State Auth., 18 and Herr Sts., Harrisburg, general contr., heating, plumbing, electrical work for utilities, roads, and site grading, etc., for building for female employes at Embreeville State Hospital. $130,000. Plans deposit $7.50 each. Baader, Young & Schultze, 1500 Walnut St., Phila., Zone 2, archts. A. F. Jones, c/o owner, ch. engr.

Pa., Slippery Rock—General State Auth., 18 and Herr Sts., Harrisburg, installing and converting present electrical distr. sys. from D.C. to A.C. at Slippery Rock State Teachers College. $150,000. Plans deposit $10. The Rust Eng. Co., 575 6 Avn., Pittsburgh, Zone 19, engr.

South Dakota—U. S. Eng., 1709 Jackson St., Omaha 2, Neb., furnishing powerhouse and untanking house bridge cranes for Fort Randall Reservoir Proj., near Lake Andes, Serial No. CIVENG 25-066-51-38.

Tennessee—Tri-State Electric Co-operative, Copperhill, 244.5 mi. rural distr.

Fill cable devices and joints with

G & W COMPOUNDS

IMPROVE ELECTRICAL CHARACTERISTICS *ELIMINATE VOIDS*

NOVOID "A"—*(Medium soft)*—For usual installations of sealed potheads.

NOVOID "C"—*(Medium hard)*—For hot climates and exposures. For potheads, cable boxes and splice boxes.

OZITE "B"—*(Medium soft)*—For general use, particularly recommended for cable joints because of its low power factor.

NOVOID "X"—*(Oil insoluble)*—For potheads and cable joints when necessary to avoid troubles due to migration. It has a tendency to "stay-put".

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7786 Dante Ave. Chicago 19, Ill.
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lines, Fannin, Polk and Cherokee Counties. Patterson & Dewar, Rutland Bldg., Decatur, Ga., engrs.

Tex., Dallas—Dallas Power & Light Co., Dallas Power & Light Bldg., plans by Smith & Mills, 921 Mercantile Bank Bldg., 2½ story, brick veneer, concrete garage and maintenance, incl. metal sheds, concrete, steel fdn. $330,000. Zumwalt & Ninther, Mercantile Sec. Bldgs., and Mullen & Powell, Reserve Loan Life Bldg., consult. engrs.

Tex., El Paso—Mountain States Telephone & Telegraph Co., 510 Texas St., plans by R. C. Bryant, Box 960, Denver, Colo., telephone and telegraph equip. and storage. $200,000.

Utah, Ogden—Utah Power & Light Co., Kearns Bldg., Salt Lake City, warehouse and office. Leslie F. Hodgson, 807 Eccles Bldg., archt.

Low Bidders & Contracts Awarded

Ill., Springfield—Sangamo Electric Co., 1301 N. 11 St., 2 story, 20,000 sq. ft. plant addn., to Austin Co., 510 N. Michigan St., Chicago, Zone 10, $160,000.

Ill., Waukegan—Public Service Co. of Illinois, 72 W. Adams St., Chicago, Zone 3, superstructure Electric Generating Plant 9, to Bates & Rogers, 600 W. Jackson St., Chicago, Zone 6, Approx. $12,-000,000.

New Mexico—Bureau Reclamation, Dpt. Interior, Bldg. 1 A, Denver Federal Center, Denver, Colo., Schedule 1, constract 80 mi. Socorro-Albuquerque 115-kv transmission line using overhead ground wires for entire length of line, Rio Grande Proj., Spec. DC-3206, to Reynolds Electrical & Engineering Co., Inc., 718 N. Piedras St., El Paso, Tex., $624,419. Bids 11/8, awarded 11/27.

Tex., Alvin—Community Public Service Co., Electric Bldg., Fort Worth, rehabilitation, exten. electric light and power plant, lighting sys., force account. Approx. $90,-000.

Tex., Dallas—Dallas Power & Light Co., Dallas Power & Light Bldg., 60,000 volt transformer station in St. Lamar Industrial Dist., own forces. Approx. $250,000.

Washington—Bonneville Power Admin., 827 N.E. Oregon St., Portland, Ore., constr. 76.6 mi. Columbia-Grand Coulee No. 4 230-kv transmission line, Douglas, Grant and Okanogan Counties, Spec. Inv. 5451, from Smith & White, Pier 65, Seattle, $674,821.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Minn., Babbitt—Reserve Mining Co., c/o Republic Steel Corp., Republic Bldg., Cleveland, O. and Armco Steel Co., 1929 Armco Ave., Middleton, O., taconite pellet pilot plant, opening mine and constructing town, $7,500,000; taconite pellet plant, 47 mi. railroad, loading facilities dock and harbor, Beaver Bay on Lake Superior, $60,000,000.

N. J., Trenton—Dpt. Navy, Yards & Docks Annex, Arlington, Va., laboratory (high pressure blower and test wing) NOY 22367, $4,600,000. Frank Grad & Sons, 187 Market St., Newark, archts.

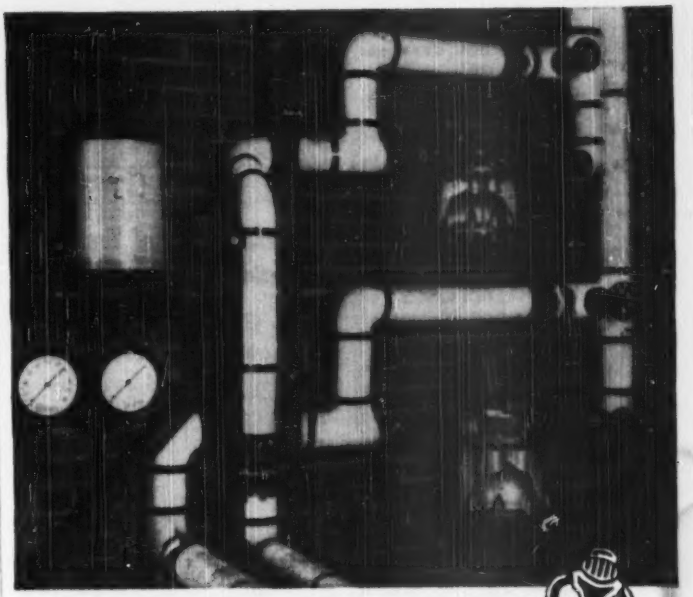
Tex., Fort Point—Aluminum Co. of America, Fort Point, via Port Lavaca, aluminum producing plant expansion, "Pot Line" unit. $7,000,000.

Tex., Houston—Port Comn., Wharf 13, port terminal, 950-acre tract on channel near Morgans Point, $5,000,000. W. F. Heavy, c/o owner, engr.

Low Bidders & Contracts Awarded

N. C., Wallace—J. P. Stevens & Co., Inc., 44 Leonard St., New York, N. Y., textile plant to produce fabrics from synthetic yarns, to C. M. Guest & Sons, Box J-1, Greensboro, approx. $5,000,000.

S. C., Aiken—U. S. Atomic Energy Comn., 1901 Constitution Ave., N. W. Wash., D. C., awarded contract to build and operate plant to produce tritium for H-bombs, to E. I. du Pont de Nemours & Co., du Pont Bldg., Wilmington, Del., Approx. $260,000,000.



How to "Clock" an Oil-Fired Turbine!

The meters shown above are measuring every drop of Bunker C fed to the oil-fired turbines in a large eastern power plant*. Here's why . . .

1. **To provide accurate fuel cost per kilowatt-hour.**
2. **To indicate whether or not the turbines are operating at top efficiency.**

These Bowser Xacto meters are on the job because they are . . . by performance . . . the world's most dependably accurate meters.

*Name on request.

You can accurately determine kilowatt-hour oil costs and check boiler efficiency with Bowser Xacto meters. Write today for full facts.

GAS OIL METERS

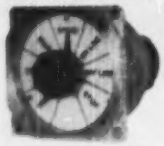
Bowser meters are also widely used in gas plants to accurately check gas oil consumed in scrubbers.

DIESEL FUEL METERS

Many plants using diesel engines for power generation use Bowser Xactos to check diesel fuel consumption.

BOWSER, INC., 1384 CREIGHTON AVENUE FORT WAYNE 2, INDIANA

SIG-TRANS
SIGNAL TRANSMISSION SYSTEMS



4" TO 40"
TRANSMITTERS
& INDICATORS

FOR ACCURACY & RELIABILITY
SYNCHRO
SIGNAL TRANSMISSION SYSTEMS
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Valve Position • Door Position
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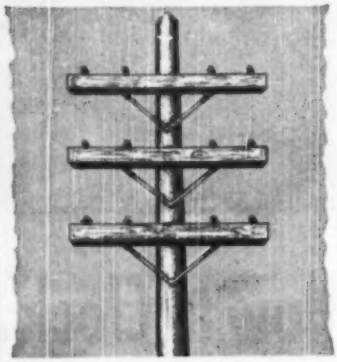
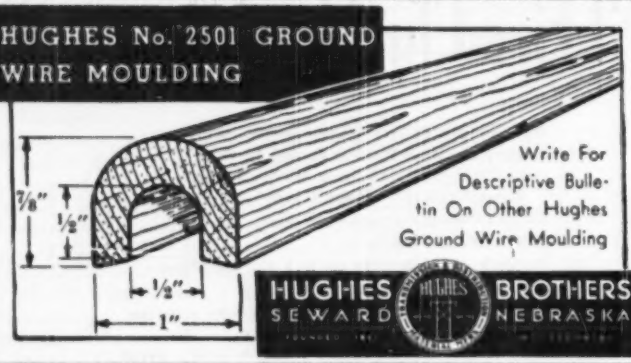


HUGHES No. 2501 GROUND
WIRE MOULDING



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Descriptive Bulletin On Other Hughes
Ground Wire Moulding

HUGHES BROTHERS
SEWARD NEBRASKA

FOR REDUCED MAINTENANCE COSTS
Subox & Subalox
Simplified Anti-Corrosive Paint Systems
Self priming and interchangeable, Subox & Subalox lend themselves to simplified and harmonious maintenance paint systems — since all varieties have one distinctive basic pigment, chemically active suboxide of lead (Pb_2O).
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Subox Inc.
Write for Full Information and System Data

BUY
all the U. S. Saving
Bonds you can
and
KEEP
all the U. S. Savings Bonds
you buy

Switch Performance

(*Continued from page* 81)

rent interrupted at the time of opening will give the loop impedance. This value will be applicable to the circuit regardless of the value of current to be interrupted by the horn-gap switch at some other time.

As an additional convenience, horizontal guide lines representing allowable safe reaches for switch types and construction in common use have been added to Fig 6. These indicate directly whether a particular switch, depending on its clearance, can be safely operated or not. In determining these values "Allowable Safe Reach" has been arbitrarily assumed as one foot less than minimum phase-to-phase or phase-to-ground clearances. This one foot margin is however a matter of operating judgment and it may be possible to dispense with it on the basis that an arc would have to extend directly across the most critical clearance distance and back in order to have reach equal to the safe clearance. Possibility of the combination of such wind direction with no circuitousness of the arc is remote, and of course, some factor of safety has already been added in drawing the upper envelope (the limit of probable "reach") of Fig 4.

It is recognized that there are limitations in developing theoretically firm conclusions from the test data. Performance of additional tests under controlled atmospheric conditions, such as could be obtained indoors, would be very desirable to evaluate presently indeterminate factors. However, it is anticipated that this application of probable reach limits to horn-gap switches will give satisfactory criteria of what the switches can do in service.

Microwave Dependable

(*Continued from page* 87)

tween the transmitter and receiver at each location.

Special Switching . . . The supervisory equipment for which the microwave provides the connecting link uses a coded sequence of four fixed-frequency tones. Experience showed that random noise in a receiver when the carrier signal was off could reach the right combination of frequencies

and time sequence to cause an unauthorized action of the control equipment. To prevent such an operation a carrier-operated relay incorporated in the receiver removes the audio input to the control equipment when the carrier from the transmitter at the plant is switched from one switching station to the other.

Of considerable importance in the operation of microwave equipment is a clear line of sight between sending and receiving ends.

Percentage-Type Relay

(*Continued from page* 97)

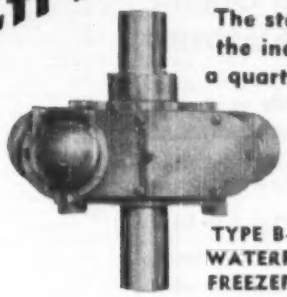
rent transformers provide relay currents for all types of load and fault conditions. For a normal load condition or a through fault, the relay currents are balanced and no operation results. For an internal fault, the currents in the relay coils at each terminal become unbalanced, with the result that both terminals are tripped for any type of internal fault.

In order to provide reliable operation on heavy through fault conditions it is necessary to carefully match the current transformers at both ends of the line. Since the current transformers must provide the voltage necessary to circulate current through the pilot-wires there will be a tendency for the current transformers to saturate on heavy through faults. If the current transformers at the two ends do not saturate to the same degree, an incorrect operation may result. Other possible sources of trouble are the effect of dc transients, residual magnetic effects in the current transformers, and unbalances in the relay circuit due to variations in pilot-wire resistance because of temperature changes. In the company's 12,000-v distribution system, the 3-phase short-circuit currents may be as high as 12,000 to 15,000 amp or 20 to 25 times the rated capacity of the circuits. Also, due to the relatively low resistance of the system, the circuits are subject to severe dc transients. These heavy fault currents and dc transients represent severe conditions which may lead to incorrect tripping.

Although these sources of difficulty existed, the relay system gave very reliable service over a long period of years, until the problem of using different types of equipment arose at the two ends of the line.

SUPERIOR outdoor disconnecting SWITCH INTERLOCK

The standard of the industry for a quarter century



TYPE B-1408
WATERPROOF
FREEZEPROOF

The Superior Heavy Duty Disconnecting Switch Interlock provides the ultimate for safety in outdoor switching stations. Designed for application to outdoor gang or group operated disconnecting switch mechanisms for positive locking of the disconnecting switch in either the open or closed position or both upon removal of the key from the Interlock.

ADVANTAGES

- Made entirely of non-ferrous materials.
- Completely protected against the entrance of moisture within the Interlock and therefore *freeze-proof*.
- Designed as a complete mechanism within itself thereby not requiring the construction of adapter plates or other extraneous parts.
- Ruggedly built to withstand the gaff of severe service conditions.

Write for catalog or ask us for specific suggestions on the type of Interlock best suited to meet your own current protection problem.

Authorized and Exclusive Service Representatives for the Bendix-Cory Interlock System

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ELECTRICAL WORLD

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BOOK REVIEWS

Mechanical Engineers Handbook

***Kent's Mechanical Engineers' Handbook*, 12th Edition. Two Volumes: *Power*, Edited by J. Kenneth Salisbury and *Design and Production*, Edited by Colin Carmichael, John Wiley & Sons, Inc. $8.50 each.**

Power . . . The new Power volume of Kent's Handbook, first published in 1895, was last revised 12 years ago. In that dozen years technology has raced ahead at a terrific pace. The new and completely rewritten 12th edition reflects the changes that have taken place. Space that in the 11th edition was given to steam engines, gas producers and other less active subjects has been given over to more modern and less widely understood subjects. There are sections on atomic power, combustion gas turbines, supersonics, marine engineering, jet propulsion, aircraft piston engines, heat pumps, panel heating, diesels and electric locomotives, axial flow compressors and instrumentation.

Although much obsolete material was left out, the volume is bigger by 20% as the result of the new material that has been added by the nearly 80 contributing authorities.

This volume's 20 sections have been organized in groups. The ingredients of power processes—air, fuel, heat and steam—are covered in the first four sections. Service functions—pumping and piping—are covered in Sec 5 and 6. Power producing equipment—boilers, turbines, condensers and gas turbines— are handled in Sec 7, 8, 9, and 10. Sections 11 and 12 are given over to heating, ventilation, refrigeration and air conditioning while transportation is covered by Sec 13, 14, and 15. Electric power, subject of Sec 16, is treated in 11 subsections: Basic Data, Power Sources, Power Distribution, Short Circuit and Overcurrent Protections, Power Factor Improvement, Substations, Switchgear, Transformers, Wire and Cable, Conversion Equipment, and Power Supply Economics. The volume's last four sections deal with atomic energy, instrumentation, power test codes and mathematical tables.

Design and Production . . . The second volume of the pair making up Kent's Handbook is directed primarily to engineers who design and manufacture machinery, appliances, equipment and engineered products in general. Its 28 sections can be classified broadly as: Selection of Materials; Design Principles; Design and Selection of Machine Components; Production Processes; Production Plant Equipment and Mathematical Tables.

Physical Tables

***Handbook of Chemistry and Physics*. By C. D. Hodgman. Published by Chemical Rubber Publishing Co, Cleveland, Ohio. 2879 pages.**

This is the 32nd (annual) edition enlarged to include the isotopes brought into prominence by nuclear physics. Other new in formation deals with the electron work functions of elements and an amplified list of letter symbols and abbreviations of scientific and engineering terms. Heaviest sections are those tabulating properties and constants of isotopes, compounds, industrial chemical products, heat, hygrometry, ect. Text is minimized for the sake of organized data.

Television

***Television Servicing*. By W. H. Buchsbaum. Published by Prentice-Hall, Inc., New York 11, N. Y. 340 pages, illustrated. Price $5.35.**

Since no one can do an intelligent and competent job of television servicing without knowing how the sets and their components work the author devotes the first half of the book to simple explanation. Then follow the details of set alinement, antenna installation and the identification of immediate difficulties. The final quarter treats trouble shooting and how to do it systematically and effectively for prevailing types of sets. Sources of interference and distortion are identified and the remedy set forth in gratifyingly simple terms.

ECA and Electricity

***Interim Report on the European Recovery Programme*. Vol III, Sec IV Electricity. Published by Columbia University Press. 60 pages, illustrated. Price 90c.**

This is the report of the electricity committee of the Organization of European Economic Co-operation as of December 1948 for the period 1948-1952. It covers 20 million-kw shortage to call for 441 million dollars of international aid. There are detailed statistics for 16 European and 2 colonial areas.

CATALOGS • BULLETINS

● THERMAL INSULATION: "Build and Insulate with One Material" deals with Marinite. The four-page folder mentions use of the material for breechings, ovens and driers, and fireproofing structural steel. Johns-Manville, 22 E. 40th St, New York 16, N. Y.

● UNIT SUBSTATION: Single circuit unit substation type SCS is covered in Bulletin 11B7457. Transformer, regulator, and switchgear are contained in a single weatherproof enclosure. Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

● RUBBER MOUNTING: Described in a new catalog section is Vibropad, a rubber pad together with rubber tubes and snubbers from which individual mountings to muffle the shock, noise, and vibration may be fashioned for machinery creating these conditions. The B. F. Goodrich Co, Akron, Ohio.

● BRAZING: Bulletin 20 tells where and how to use Easy-Flo and Sil-Fos for low-temperature silver alloy brazing. Applications and fast brazing techniques are described. Handy & Harman, 82 Fulton St, New York 7, N. Y.

● LUMINAIRES: Sixteen-page Bulletin 2413 contains information and catalog data about the Coronet series of fluorescent luminaires for stores, offices, and schools. Curtis Lighting, Inc, 6135 W. 65th St, Chicago 38, Ill.

● METALLIZING: Volume 5, No. 4 of Metco News shows uses of Meteloy No. 2 high-chrome, high-carbon stainless steel alloy. One example is the rebuilding of the worn section of the spindle of a 20-year-old 5-kw turbine. Metallizing Engineering Co, Inc, 38-14 30th St, Long Island City 1, N. Y.

● THERMOCOUPLES: A 42-page catalog Bulletin TC-8, lists application recommendations and prices for resistance bulbs and wells, radiation detector, special thermocouples for plastic injection and extrusion machines, and a new molten metal thermocouple for ferrous metals. Wheelco Instruments Co, 847 W. Harrison St, Chicago 7, Ill.

● MATERIALS HANDLING: A condensed catalog contains basic specifications of its entire line of materials handling equipment. This includes fork-lift trucks, towing tractors, and twenty special attachments. Clark Equipment Co, Industrial Truck Div, Battle Creek, Mich.

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(Continued on following page)

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U. S. Government

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1	300	G.E.	Non-condensing 140/175 I.S.P. 5/10 B.P.—480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

	KVA	Make	Type	Volts	Speed
1	6160	Whse.		2400/4160	600
1	4000	G.E.	TSC	2400/4160	900
1	4000	Whse.		2400/4800	720

MOTOR GENERATOR SETS

3 ph. 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
2	2000	G.E.	300	600 DI CF	11000
1	1250	G.E.	600	125/250	2300/4160
1	1000	G.E.	360	275	2300/4160
1	1000	G.E.	514	250	2300
1	1000	Whse.	514	250	4160
1	1000	Whse.	900	275	
1	750	Whse.	900	275	2300/4160
1	500	Whse.	900	250	2300/4000
1	400	Whse.	900	250	4160
1	400	G.E.	900	250	440/2300

TRANSFORMERS—60 Cycle

K	Make	Type	Ph	Voltages
3—2000	Whse.	OISC	3	66000x11000
1—2500	Al. Ch.	OISC	3	18200x2300
2—1250	G.E.	HVDDJ	1	66000x2300
1—1000	GE	HT	3	18200x2300 4000
1—667	Whse.	OISC	3	66000/34,500x2300
1—600	GE	HT	3	18200x2300/4000
1—600	Al. Ch.	OISC	3	2300/4160x220/440
1—333	Pitts.	OISC	1	7640Ox2400

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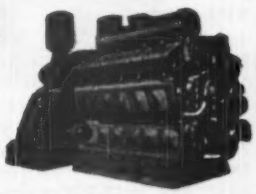

A PARTIAL LISTING OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	38F16	2500	300	375	Enterprise	DSO-6	450	600
1425	Fairbanks Morse	38DH4	1900	720	300	Superior	KNA	360	514
1250	General Motors	16-278A	1800	720	313	General Motors	6-268A	450	1200
937.5	General Motors	12-267	1350	720	313	Clark	MD-6	375	514
625	Alco	6-251	750	600	187	Ingersoll Rand		225	514
625	Baldwin	VO-6	810	450	125	General Motors	3-268A	150	1200
600	Buckeye	80	480	600	75	General Motors	6046C	90	1800

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TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4160V, 2300V Pyranol
1—1000 KVA G.E., 3 Ph., 4150V, 2400V
1—1000 KVA G.E., 3 Ph., 4150V, 2 Ph., 2400V
1— 500 KVA Kuhlman, 1 Ph., 4150V, 2300V
3— 400 KVA G.E., 1 Ph., 6900V, 2300V Sec.
3— 250 KVA Maloney, 1 Ph., 13,800V, 240/480 Sec
3— 100 KVA G.E., 1 Ph., 4150V, 240/480 Sec.
3— 75 KVA Whse., 1 Ph., 2200V, 440V Sec.
1— 75 KVA G.E., 3 Ph., 2400V, 240/480V Sec.

MOTOR GENERATOR SETS

2—1000 KW G.E., 600V, 600 RPM, 4000V Syn.
2—1250 KW G.E., 275V, 600 RPM, 4000V Syn.
1—1000 KW G.E., 600V, 514 RPM, 4000V Syn.
2— 150 KW G.E., 125/250V, 1200 RPM, 4000V Syn.

SLIP RING MOTORS

1—2500 HP G.E., WT, 257 RPM, 6900V
1— 100 HP G.E., WT, 600 RPM, 440V

SYNCHRONOUS CONDENSER

1—2500 KVA Whse., 720 RPM, 2300V with D.C. Exc.

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LETTERS TO THE EDITOR

Post-Election Questions

To the Editor:

Now that the campaign oratory has ceased, and the votes have been counted, it might be well for utility industry executives to consider a few angles of the socialized electric power controversy.

1. Although Democrats often cited federal power projects as an outstanding accomplishment of the administration, in only two or three instances did Republicans point to them as being part of the administration's trend toward socialism.

2. In no case did a Republican speaker point out the vast sums of tax money spent on federal projects, the injury they are doing to private enterprise, the unfair discriminatory practices they indulge in, their completely socialistic nature, or the extent to which they are being extended over the whole United States.

This is the more remarkable since almost every speaker called attention to the threat of socialized medicine—which so far is only a suggestion, and to the Brannan plan for controlling farmers and their prices—which is also only a proposal. The one great socialistic scheme on which the government has really "gone to town" and which has already destroyed several large utility companies and injured many others, was almost completely ignored. Why?

Perhaps the utility industry might do well to take a sheet from the medical profession's book. The doctors have done a good job of putting their case before the public.

Public electric power was the subject of a recent "Town Meeting Of The Air." Many false or misleading statements were made by the advocate of socialized electric power, while the case against public power was presented in a very weak manner by a former utility executive. Little attempt was made to show the fallacy of the "cheap public power" claims. Why?

A few weeks ago it was reported that a certain Republican member of the U. S. Senate proposed to "investigate" a monthly magazine that published an article criticising federal power projects. The article was well written by a former governor of the region. The facts stated have never been defended by the utility industry. Why?

In the past election we have seen what the voting public thinks of socialism and communism. But most voters remain pitifully ignorant of the evils of the administration's public electric power schemes. Why?

H. T. Wilson

Huntington, W. Va.

Lineman in Jeopardy

To the Editor:

"Three R's of Safety", Oct 9th. The article is fine, but your Lineman on the front page needs a little dressing up. These are my personal observations and would tend to detract from the point of the article:

IS his life in danger?

1. The open skinning knife attached to a metal hook

2. Another metal hook to which the glove bag is attached

3. The bare lag wrench in the safety belt

4. The third tool. I'm not sure what it is—but these four violate the Electrical Workers Safety Rules of the State of Washington

5. The lineman is not in a good position as his safety rope is too long. He is not far enough up the pole. These two conditions cause him to reach too far and increase his chance of cutting out or straining his muscles.

These are intended to be constructive and in no way to make fun of the picture.

L. W. Stockwell
Crew Dispatcher
Puget Sound Power & Light Co
3003 E. 120
Seattle 55, Wash

(Editor's Note: Anyone wish to defend our lineman?)

More Power for Hay Drying?

To the Editor of Electrical World:

The picture story "Farmers in Ole Virginny Like the Electric Hay Dryer" in the October 23 Electrical World is a fine plug for a very worthwhile development. More power to you and to mow hay curing. The latter is exactly what I want to ask about, "more power to mow hay curing," because it's going to be needed.

Those Virginia farmers are probably drying the usual timothy and clover hay. But what about the unusual kinds of hay, not so widely grown now but which will become more and more important as farmers learn of their values?

Take ladino, for instance. It has a very high protein content, but is extremely sappy; moisture content runs as high as 80% and averages about 60. It has to be dried down to 30, not over 40% moisture.

For instance take a farmer who has had a hay dryer for 3 or 4 years and is well pleased with it. He hears about the fine feeding value of ladino and decides to switch over from timothy and clover. Then he finds that the 20,000 cfm of air at atmospheric temperature delivered by his dryer fan just won't dry the ladino down enough. What's he going to do?

The answer to that question is up to the power companies and others who are promoting farm electrification. Possibly the answer is more air through the hay—a bigger fan and a bigger motor to drive it. Or it may be to warm the air with electric heaters. Or it may be a revision of the drying method. Whatever it is, the answer must be forthcoming.

S. T. Henry

Spruce Pine, N. C.

Let's *Look at* the "MK-40" *Contacts*

Thruout the entire range, from 400 to 5000 amperes and from 7.5 to 230-kv., the "MK-40" has many outstanding features, all essential to give better, smoother and easier operation. Most vital of these are the high pressure silver-to-copper contacts at both ends of the floating tubular blade—the simple and logical way to eliminate flexible shunts. Their design is of primary importance on an outdoor air switch exposed to year-round weather and corrosive atmospheric conditions. All parts are in plain view for visual inspection.

Plan view of 1200 ampere "MK-40".

Close-up showing multiple leaf pressure applying springs and separate current carrying contact shoes.

Arrangement of contact shoes and springs at hinge end is identical to the contact end.

Ask for Publication 4807

ONLY THE "MK-40" HAS ALL THESE FEATURES

1. Identical high pressure contacts at both ends of the blade are backed by sturdy beryllium alloy springs. Current carrying function is independent of the pressure applying members to take full advantage of the electrical and mechanical characteristics of the materials used.

2. Large spring deflection maintains constant contact pressure over a long period of years. There are no other springs or moving contact surfaces; no small parts.

3. Current interchange surfaces are reduced to an absolute minimum. Rolled or drawn sections are used. Hinge pins carry no current.

4. Contact material is a good heat conductor with ample volume to carry away heat generated under short circuit.

5. Metals at the point of contact are silver-to-copper to resist corrosion and abrasion.

Plus of course—smooth ease of operation with blade under full control at all times; locking in both opened or closed positions.

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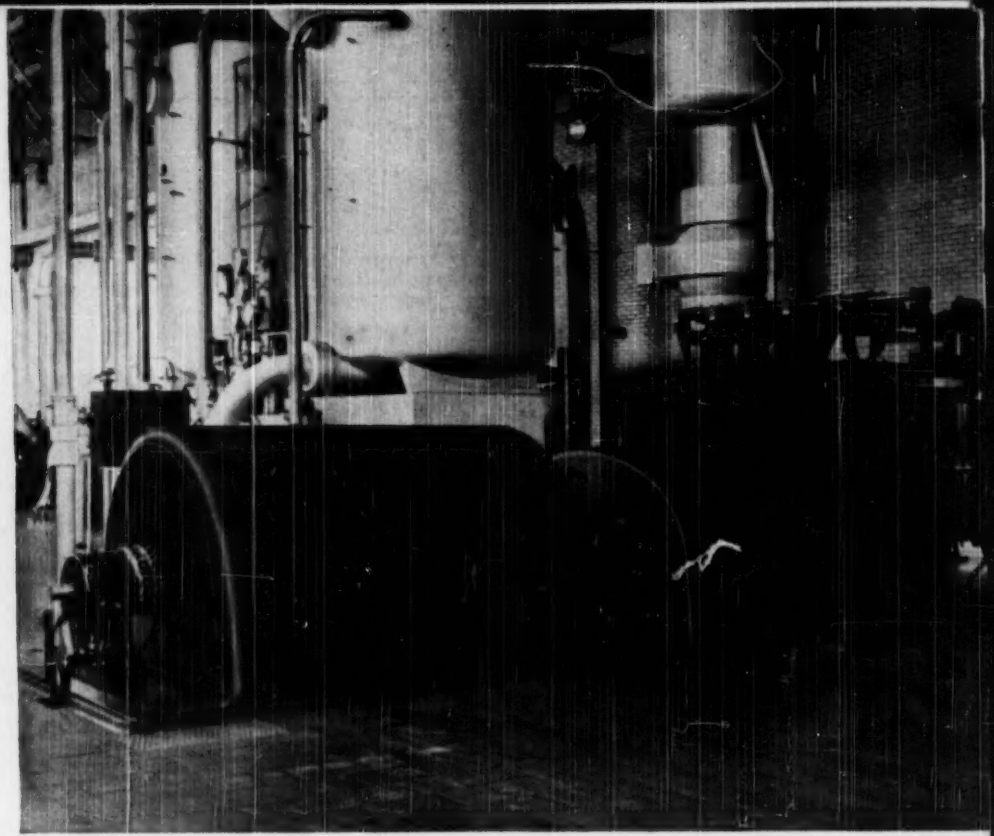

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A Standard Oil lubrication specialist will be glad to supply you with actual case histories of utility operations on which Nonpareil Turbine Oil has reduced lubrication costs as much as 68%. To arrange for his visit, write: Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.

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